Value Beyond Cost Savings

How to Underwrite Sustainable Properties

Expanded Chapter III: Evaluating Property Sustainability

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GREEN BUILDING FINANCE CONSORTIUM
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About Expanded Chapter III

This publication is Expanded Chapter III of the Consortium's book: *Value Beyond Cost Savings: How to Underwrite Sustainable Properties. Value Beyond Cost Savings* presents the key findings and conclusions regarding the valuation and underwriting of sustainable properties based upon three years of independent research by the Green Building Finance Consortium.

Chapter III is one of six "Expanded Chapters" from *Value Beyond Cost Savings: How to Underwrite Sustainable Properties* which together provide 400 additional pages of in-depth research, analysis, and performance information, all available without charge to the public from the Consortium's website and other locations.

This Expanded Chapter has the same table of contents as the book, enabling readers wishing to delve into more depth on a topic to easily find the appropriate sections in the Expanded Chapters. This book also references many checklists, databases, documents, and resource links in the Expanded Chapters and in the Consortium's web-based Research Library. This Chapter and the book include some color, but the publications are designed to print in black without loss of information.

The Green Building Finance Consortium maintains a searchable Research Library and Industry Links database on its website: http://www.GreenBuildingFC.com. The Research Library and Industry Links databases include thousands of documents coded using the GBFC's unique index designed for the sustainable finance and investment industry. The structure of the index is consistent with the organization of *Value Beyond Cost Savings: How to Underwrite Sustainable Properties*. Future sustainable performance and related research updating the book on an ongoing basis will be available in the Research Library.

The mission of the Consortium is to enable private investors to evaluate sustainable property investments from a financial perspective. To accomplish this, we have identified and developed suggested modifications to valuation and underwriting methods and practices and are widely communicating the results of our work through our book, other publications, web-based research library, speeches, and collaborations.

The Consortium is financed independent of green building product or professional organizations, relying on funding from The Muldavin Company Inc. and Consortium Members which include leading real estate industry trade associations and companies, governments, and non-governmental organizations. Trade association members include BOMA International, the Mortgage Bankers Association, the Urban Land Institute, the Pension Real Estate Association, and the National Association of Realtors.

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Collaborators/Other Contributors

We are and have been involved in important collaborative efforts addressing database development, energy research, valuation practice, and many other areas critical to financial assessment of sustainable properties with at least the following organizations:

- **Lawrence Berkeley National Laboratory**—energy and health issues
- **CoreNet Globa**l—energy issues
- **Royal Institute of Chartered Surveyors**—valuation and policy issues
- **Appraisal Institute**—valuation issues, training
- **National Association of Realtors**—sustainability curriculum
- **North American Commission for Environmental Cooperation**—policy, finance
- **Vancouver Valuation Accord**—valuation and regulatory issues
- **Database for High Performance and Sustainable Buildings**—database design and development
- **Rutgers Green Building Research Cente**r—REIT valuation research, other
- **International Youth Leadership for a Sustainable Future**—youth education
- **World Business Council for Sustainable Development**—analytics and communications
- **California Energy Commission**—transaction disclosure documents

We also appreciate the scores of other individuals and companies who have provided significant input and assistance in the project through their research and data, review of Consortium work product, and participation in interviews and surveys.

About the Author

Scott Muldavin is Executive Director of the Green Building Finance Consortium, a group he founded in 2006, and President of The Muldavin Company, Inc. For over 25 years, Mr. Muldavin has advised leading real estate companies including CalPERS, RREEF, Bank of America, Mitsui Trust and Banking, Great West Life, Prudential Real Estate, Ohio State Teachers Retirement System, Wells Fargo Bank, The Government of Singapore Investment Corporation, Catellus Development Corporation, Equitable Real Estate, and Standard Insurance Company.

Mr. Muldavin has been a lead real estate consulting partner at Deloitte & Touche, co-founded the $3+ billion private real estate company Guggenheim Real Estate, served on the Advisory Board of Global Real Analytics, an advisor for $2 billion of REIT and CMBS funds, and completed over 300 consulting assignments involving real estate finance, mortgage lending, investment, valuation and securitization. Mr. Muldavin’s

engagements and work experience provide him with broad experience in equity and debt transaction structuring, underwriting, due diligence, investment fund design, and corporate real estate.

Mr. Muldavin has advised scores of equity investors and developers. As a co-founder of Guggenheim Real Estate, Mr. Muldavin has been involved in capital formation, investment strategy, due diligence and served on the investment committee. He has assisted pension funds including CalPERS, Ohio State Teachers, and Alaska Permanent Fund in their investment and organizational strategies. He has advised investment managers including RREEF, Prudential Real Estate, Amstar, Hunt Realty, and others on strategy, capital formation, organizational change, and due diligence practices.

Mr. Muldavin has been involved in the Real Estate Investment Trust (REIT) market since the early 1980s advising clients including Merrill Lynch, CalPERS, Kilroy Realty and others concerning new REIT securities offerings and investment issues. As an investment committee member of Guggenheim Real Estate, he monitored the REIT market and participated in investment decisions concerning the allocation of hundreds of millions of dollars of REIT investments.

Mr. Muldavin has been involved in mortgage underwriting for over 25 years. He was the lead consultant that developed the first commercial mortgage risk-rating system for Standard & Poor's Corporation in the early 1980's and was a national leader of the Real Estate Financial Institutions practice for Deloitte & Touché, where he worked with financial institutions to improve their underwriting and servicing systems, assess risks in their mortgage portfolios, and estimate loan losses. He also authored the quarterly "Real Estate Finance Update" in *Real Estate Finance*, for 16 years; developed the Real Estate Capital Flows Index, which was published quarterly for many years by the Pension Real Estate Association and Institutional Real Estate Inc.; and authored key articles and reports on mezzanine financing, mortgage servicing, risk management, capital volatility, and other topics.

Mr. Muldavin was also a leader of the corporate real estate practice at Deloitte and Touché and during his career has advised corporations such as Texaco, Phoenix American Corporation, Nissan Motors, Pacific Enterprises, Universal Studios, House of Blues Corporation, Johns Manville, and many others on their leasing, acquisition and real estate strategies.

Mr. Muldavin has been involved in the structuring and due diligence of real estate property and business transactions for over 25 years. He has completed due diligence engagements involving the acquisition of office buildings, retail properties, hotels, multi-family properties, industrial properties, large land parcels, mortgage portfolios, mortgage companies, commercial banks, real estate service companies and other real estate assets.

As an advisor and Investment Committee member of Guggenheim Real Estate, Mr. Muldavin reviewed hundreds of retail, office, industrial and multi-family investment

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Mr. Muldavin is a frequent speaker on real estate finance, investment, valuation and sustainability. He has authored over 225 articles published in *Real Estate Finance*, RICS Property World, *Bankers Magazine*, *Urban Land, European Real Estate Yearbook, The Journal of Property Management, The Pension Real Estate Quarterly*, *Real Estate Issues, The Investment Property and Real Estate Capital Markets Reports, Institutional Investor, Builder and Developer*, *The Real Estate Accounting and Tax Journal*, and other industry publications.

Mr. Muldavin is a graduate of UC Berkeley and Harvard University, and has been recognized by the American Society of Real Estate Counselors and the Royal Institute of Chartered Surveyors, each of who have awarded him their highest level of professional certification. Mr. Muldavin is also on the Advisory Board of the Journal of Sustainable Real Estate and an Honorary Fellow of the Institute of Green Professionals.

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Chapter III Contents

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Evaluating Property Sustainability[1]

Value Beyond Cost Savings					
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A. Introduction

This is the third chapter of the six-chapter book: *Value Beyond Cost Savings: How to Underwrite Sustainable Properties*. Evaluating a property's sustainability can be difficult and confusing. This chapter provides some insights and methods for evaluating a property's sustainability from a financial performance perspective and identifies resources to assist in this effort.

Sustainable property definitions and certifications play an important role in the financial assessment of sustainable properties. Definitions and certifications provide a basis for investors to measure and compare properties, a critical foundation for financial analysis.

Significantly, existing green building certifications like LEED®, BREEAM, GreenStar, CASBEE, or LEED India measure environmental outcomes, not financial outcomes, and thus cannot be the sole basis for underwriting from a financial perspective. For example, environmental certifications focus on energy, water, and materials design, performance or practices, but not on how the market responds to such performance. Accordingly, environmental certifications are an important building performance indicator, but are a few steps away from offering financial insights (Chapters IV and V focus on these issues).

Practically, reliance on a single certification program for underwriting is not realistic because investors must be able to evaluate the financial implications of sustainable

[1] The terms "sustainable" and "green" are used interchangeably in this book, and often in the industry and media. Readers should be aware that the terms "green," "sustainable," and "restorative" design and construction are not well defined or consistently applied or understood in the industry. From a financial perspective, what is important is to understand a property's combination of sustainable features or attributes and to recognize that a property's "sustainability" is really a continuum: from making basic changes in operations and maintenance practices to the design and development of restorative buildings that maximize benefits to the environment and community.

property investment, however large or small, regardless of whether a certification has been achieved. Investors with properties in different markets or countries must employ underwriting practices that are adaptable to local conditions.

Financial analysis of a specific property requires a clear understanding of the linkage between how a property is defined as "sustainable" and its related value. How a property is defined as "sustainable" is another way of saying how the property's sustainability is measured. Chapter IV presents GBFC's Sustainable Property Performance Framework that presents a section on "Building Performance" which provides some guidance for measuring a buildings "sustainability" and clarifies the links to market and financial performance.

Further, as explained in Chapter V, evaluating a property's "sustainability" is just the second step of GBFC's six-step financial analysis process for sustainable properties. Once a property's "sustainability" is assessed, costs and benefits must be identified, the financial implications of the property's sustainable costs-benefits assessed, financial model inputs selected, and a detailed risk analysis conducted.

What is clear is that no single certification or rating system will suffice in conducting a financial assessment of a property's sustainability. At a minimum, the specific threshold sustainability requirements necessary to obtain benefits, or mitigate costs, from regulators, space users, and investors must be identified and evaluated for each specific property.

Expanded Chapter III provides a framework for evaluating a property's "sustainability", provides detail on sustainable property features, and assists readers in assessing the role of certifications in financial analyses and valuation. This chapter is presented in the following sections:

- What is a sustainable property?;
- Sustainable property features;
- Measuring a property's sustainability;
- How sustainable property certifications affect value; and,
- Key research comparing sustainable rating systems.

1. Applying the Findings and Conclusions

This chapter has broad applicability to sustainable property investment decision-making. However, the work is primarily directed to specific audiences and decisions in the private commercial real estate market as discussed below.

Target Audiences: The target audiences for this section are space users[2], equity investors, lenders, developers, appraisers, and commercial property brokers. Sustainable service providers and groups seeking capital for sustainable property investment will also benefit from this section, as well as students and industry practitioners seeking to understand the financial underpinnings of sustainable property investment.

Commercial Real Estate Properties: The Consortium focuses on commercial and multifamily properties. While many of the frameworks and methodologies will have some applicability to the single-family market, single-family property issues are not addressed in detail. Select single-family resources are also available on the Consortium's Research Library and Industry Links under code 19.2.

Geographic Applicability: Individuals and organizations throughout the world influence The Consortium's work. Additionally, the Consortium's focus on fundamental methods and practices make its work particularly transferable across national boundaries. However, this section has a North American bias given the author's background and experience.

Property Specific Investment Decisions: This chapter focuses on performance assessment and valuation of individual properties.

Property Life Cycle: This section is applicable to sustainable property investment decisions involving new buildings, existing buildings, and tenant improvements.

Private Investment Decisions: The Consortium focuses on the underwriting of private investment decisions. However, understanding the types and magnitude of public benefits generated by a specific sustainable property investment is important to a private investor because of the potential to monetize public benefits by extracting the value they create for governments and tenants-investors.

Sustainable properties can have substantial social and environmental (public) value, and it is important to quantify and understand such benefits. Methodologically, public and private benefits should be assessed separately, and particularly from the perspective of valuation, it is critical to separate the concept of public and private value when evaluating a sustainable investment decision from a private sector perspective. This does not mean that public values and benefits cannot be considered by the private sector when making investment decisions, but only that such decisions should be made with a clear understanding of the differences between private and public values.

[2] "Space user" is a term we use to describe the occupants or users of real estate. It is a term that includes corporate and non-corporate owner-occupants, tenants, retail customers or other non-owner or tenant users of space.

B. What is a Sustainable Property?

1. Financial Perspective

Proper financial analysis of a property requires explicit consideration of the potential benefits that will accrue through meeting regulator, space user, and investor thresholds for sustainability. The definitions that matter for a property are those used by regulators, space users and investors. Regulators typically have a whole series of required thresholds in building codes and ordinances in order to meet their regulatory requirements and/or obtain incentives, while space user definitions of "sustainability might incorporate an environmental rating such as LEED, internal company energy efficiency guidelines, or broader measures such as the Global Reporting Initiative or Carbon Disclosure Project.

The specific certifications/definitions required by regulators, users, and investors will vary dramatically by country, government level, property type, property size, tenant mix and other factors. Fortunately, while evaluating sustainable certifications from a financial perspective can be complicated, analyzing regulator, user, and investor requirements at a property level is a core expertise practiced for decades by real estate appraisers and underwriters.

A property's "sustainability," for financial assessment purposes, must be based on a clear understanding of the property's combination of sustainable features and attributes, as well as its certifications. Underwriters and valuers must understand a property's features and attributes well enough to select and appropriately adjust evidence from comparable properties and determine the applicability of research, tenant surveys, and other information.

2. General Perspective

While this chapter focuses on financial analysis, it is important to understand the various ways sustainable properties are described to provide background and perspective for interpreting how definitions/certifications influence value.

A general consensus has emerged on the fundamental attributes of a sustainable property. One of the earliest general definitions of sustainability was adopted in 1987 by the United Nations World Commission on Environment and Development (WCED), which defined "sustainable development" as "development that meets the needs of the present without compromising the ability of the future generation to meet their own needs"[3].

Another good succinct definition from the YourBuilding.org website is:

> A sustainable commercial building can be defined as a building with planning, design, construction, operation and management practices that reduce the impact of development on the environment. A sustainable commercial building is also

[3] Report of the World Commission on Environment and Development, United Nations, 1987.

> economically viable, and potentially enhances the social amenity of its occupants and community.[4]

ASHRAE, in their 2006 *Green Guide*, provide a bit more detail on the environmental outcomes necessary for a green/sustainable building:

> Specifically, the view of this chapter's authors is that a green/sustainable building design is one that achieves high performance, over the full life cycle, in the following areas:
>
> - Minimizing natural resource consumption through more efficient utilization of nonrenewable natural resources, land, water, and construction materials, including utilization of renewable energy resources to achieve net zero energy consumption.
> - Minimizing emissions that negatively impact our indoor environment and the atmosphere of our planet, especially those related to indoor air quality (IAQ), greenhouse gases, global warming, particulates, or acid rain.
> - Minimizing discharge of solid waste and liquid effluents, including demolition and occupant waste, sewer, and stormwater, and the associated infrastructure required to accommodate removal.
> - Minimal negative impacts on site ecosystems.
> - Maximum quality of indoor environment, including air quality, thermal regime, illumination, acoustics/noise, and visual aspects to provide comfortable human physiological and psychological perceptions.[5]

It is also important to think about the definition of sustainability from a broader perspective of how buildings fit within our environment. The American Institute of Architects (AIA) Committee on the Environment definition of sustainability and sustainable design articulates one good example of this broader way of thinking about sustainability:

> "Sustainability envisions the enduring prosperity of all living things. Sustainable design seeks to create communities, buildings, and products that contribute to this vision.
>
> **Measure 1: Design & Innovation**
> Sustainable design is an inherent aspect of design excellence. Projects should express sustainable design concepts and intentions, and take advantage of innovative programming opportunities.
>
> **Measure 2: Regional/Community Design**
> Sustainable design values the unique cultural and natural character of a given region.
>
> **Measure 3: Land Use & Site Ecology**

[4]Danielle McCartney and Patrick Burke, "Definition of Sustainable Commercial Buildings," September 27, 2007 (http://www.yourbuilding.org/display/yb/Definition+of+sustainable+commercial+buildings)

[5] ASHRAE *Green Guide: The Design, Construction, and Operation of Sustainable Buildings*, 2006, pg. 4. www.ashrae.org.

Sustainable design protects and benefits ecosystems, watersheds, and wildlife habitat in the presence of human development.

Measure 4: Bioclimatic Design
Sustainable design conserves resources and maximizes comfort through design adaptations to site specific and regional climate conditions.

Measure 5: Light & Air
Sustainable design creates comfortable interior environments that provide daylight, views, and fresh air.

Measure 6: Water Cycle
Sustainable design conserves water and protects and improves water quality.

Measure 7: Energy Flows & Energy Future
Sustainable design conserves energy and resources and reduces the carbon footprint while improving building performance and comfort. Sustainable design anticipates future energy sources and needs.

Measure 8: Materials & Construction
Sustainable design includes the informed selection of materials and products to reduce product cycle environmental impacts, improve performance, and optimize occupant health and comfort.

Measure 9: Long Life, Loose Fit
Sustainable design seeks to enhance and increase ecological, social, and economic values over time.

Measure 10: Collective Wisdom and Feedback Loops
Sustainable design strategies and best practices evolve over time through documented performance and shared knowledge of lessons learned."[6]

Although there is a general consensus on the range of environmental outcomes that a sustainable building should strive for, there is no consensus on how such outcomes should be achieved, measured, certified, or valued. Fortunately, traditional real estate underwriting and valuation methods and practices are well suited to deal with these complexities.

Mass transit orientation, community connectivity, and related land-use and planning issues are a critical component of developing sustainable communities and regions, as well as buildings. Sustainable building research and certification systems have historically not adequately addressed these types of sustainable concerns and issues, focusing more on property specific and/or technological issues. Recent changes in LEED have put more priority on site related considerations and organizations like the Urban Land Institute, a leader in the "Smart Growth" movement for years, continue to push these issues to the forefront. [7]

[6] AIA website, August 28,2008.

[7] ULI's publication in 2008 of "The City in 2050: Creating Blueprints for Change" and "Climate Change, Land Use and Energy 2009: Investment Niche or Necessity?" in late 2009 are good examples of their continuing work in this area.

This chapter and the book mention these issues, and consideration of these issues is integrated into data collection and financial models, as well as new performance frameworks, but the level of detail is limited, which is not meant to be a reflection on their relative importance to society, but more a reflection of their specific impact on property valuation and financial performance.[8]

C. Sustainable Property Features

One way to "define" a sustainable property is by its combination of sustainable features and attributes, as illustrated in the outline of the key sustainable building features of a typical office or retail property shown in Exhibits III-1 and III-2.

Sustainable certifications like LEED®, BREEAM (U.K., Europe), GreenStar (Australia), CASBEE (Japan), or Green Globes™ (US, Canada) can be achieved through a adoption of a wide combination of different sustainable features, processes and outcomes. However, just knowing a property has a certification does not provide the detail on the features and processes necessary to conduct a financial analysis.

[8] Land use issues are some of the most fundamental to achieving societal goals relative to more sustainable and low carbon cities and communities. In this book, with the focus on property level valuation and underwriting, the specific land use and building type are typically a given and factored into the analysis. To the extent that more aggressive land use regulations are implemented to address sustainability concerns, it will impact supply and demand conditions in a locality and significantly affect development, particularly for those property owners in areas that are no longer deemed appropriate to develop.

Exhibit III-1

Select Sustainable Elements -- New Office Construction

Sustainable Sites

- Optimal daylight exposure through building orientation
- Reflective roof surface to reduce heat island effect
- Brownfield or urban in-fill location
- Habitat restoration or open space preservation
- Bicycle and carpool parking
- Light pollution reduction
- Stormwater management/treatment

Water Efficiency

- Water-efficient landscaping
- Low-flow lavatory toilets and faucets
- Stormwater retention systems for landscape irrigation

Energy and Atmosphere

- High efficiency HVAC system
- High efficiency interior lighting with daylight dimming and occupancy sensors
- High performance window glazing
- Photovoltaics or other on-site renewable energy
- Additional insulation
- Commissioning of HVAC and other systems

Materials and Resources

- Environmentally friendly construction materials (regional renewable, certified, etc.)
- Waste management plan for diverting construction debris

Indoor Environmental Quality

- Low-emitting paints, flooring and carpet adhesives
- Daylighting and exterior window views
- Zoned heating and cooling
- Under-floor ventilation
- Operable windows
- Air intakes positioned away from pollution sources
- Enclosed, ventilated mechanical rooms
- CO^2 sensors

Innovation and Design Process

- Integrated design and construction approach
- Expanded design team including energy modeler, solar design expert, and commissioning agent

Exhibit III-2

Select Sustainable Elements -- New Retail Construction

Sustainable Sites

- Optimal daylight exposure through building orientation
- Reflective roof surface to reduce heat island effect
- Trees or shade structure to reduce heat island effect in the parking lot
- Brownfield or urban in-fill location
- Habitat restoration or open space preservation
- Light pollution reduction
- Stormwater management/treatment
- Pervious pavement

Water Efficiency

- Water-efficient landscaping
- Low-flow lavatory toilets and faucets
- Stormwater collection tank for landscape irrigation

Energy and Atmosphere

- High efficiency HVAC system
- High efficiency overhead light fixtures and bulbs
- Photovoltaics or other on-site renewable energy
- LED lighting for building and monument signage
- LED lights in grocery and display cases
- Increased wall and roof insulation
- Commissioning of HVAC and other systems

Materials and Resources

- Environmentally friendly construction materials (regional renewable, certified, etc.)
- Waste management plan for diverting construction debris
- Replace concrete with fly ash where possible
- Tenant handbook with recommendations on sustainable design and construction technologies
- Storage and collection of recyclable materials generated from product packaging and customer visits

Indoor Environmental Quality

- Low-emitting paints, flooring and carpet adhesives
- Integrated system of skylights, clerestories, light sensors and adjustable lights to maximize daylighting and reduce energy usage
- Air intakes positioned away from pollution sources

Innovation and Design Process

- Integrated design and construction approach
- Expanded design team including energy modeler, solar design expert, and commissioning agent

It is important to note that many sustainable features have multiple impacts on property underwriting. For example, daylighting can contribute to worker productivity and thereby increase rents. It can also reduce energy costs and thereby reduce operating expenses. Daylighting, if not property implemented, can also result in glare and/or thermal comfort problems.

On the other hand, some of the features do not have direct measurable linkages to sustainable property underwriting. Rather, their impact is felt through their contribution to achieving the standard necessary to certify the property as sustainable. For example, bike racks are a sustainable feature of the property, and can be an element that contributes to a sustainable rating or certification. However, aside from the certification itself, this element will not likely have a material direct effect on property cash flows.

1. GBFC Menu of Sustainable Features

A menu of features and elements that, in various combinations and to various degrees, define a sustainable property is presented in Appendix III-A. The list provides a description of each feature, definitions of key terms, and references to LEED® USA, Green Globes™, and a 2007 Draft of ASHRAE's 189P standards.[9] The applicability of each feature for new construction, existing building, core and shell or commercial interiors is identified. This list provides readers with a "menu" of potential sustainable property features and their link to select environmental certifications.

The list in Appendix III-A was compiled from a review of sustainable property rating systems, trade associations, publications, books, case studies and websites, including the following:

- LEED® (New Construction[10], Existing Buildings, Core & Shell, Commercial Interiors)
- Green Globes™
- ASHRAE 189P[11]
- NAHB
- BOMA International, 30 Easy Ways to Save Energy For Little or No Cost
- Sustainable Building Technical Manual[12]

[9] This menu was prepared in 2007 so some of the 189P, LEED and Green Globe references are not current, but the list and descriptions still provide insight into the range of alternative features and strategies that define sustainability for properties. 189P has gone through years of review and comment and is being finalized in early 2010.

[10] LEED-NC 2.2 (New Construction) addresses design and construction features for both new buildings and major renovations of existing buildings.

[11] ASHRAE 189P: Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings (Public Review Draft May 2007). It should be noted that ASHRAE 189P is a standard for high-performance buildings and not a sustainability rating system.

[12] Public Technology, Inc, USGBC

- And others

The linkage of features to LEED and 189P were based on systems in place in 2007. Changes have been made to both LEED and ASHRAE's 189P as of early 2010.

The list is organized according to the six LEED® categories, with the addition of Operations & Maintenance and Miscellaneous categories, as follows:

1. Sustainable Sites
2. Water Efficiency
3. Energy & Atmosphere
4. Materials & Resources
5. Indoor Environmental Quality
6. Innovation & Design Process
7. Operations & Maintenance
8. Miscellaneous

It should be noted that many of the LEED prerequisites and credits are outcome oriented, for example, Optimize Energy Efficiency. Achieving the outcome can be accomplished through a combination of features, such as daylighting, occupancy sensors, re-lamping, etc. In such instances, we have attempted to list these individual sub-features adjacent to the more general LEED feature.

2. Sustainable Property Resources

A proliferation of resources is available to developers, investors, tenants, and corporate real estate professionals to assist them in understanding the general strategies and sustainable features available to them. As the industry has matured during the last 2-3 years, the lists of optional features and strategies have become more specific to the types of decisions being made—new vs. existing, property type, etc. Significant resources are identified and described below and can be found in the Consortium's Research Library under codes 6.0: Sustainable Property Features; 18.0: Property Specific Analysis; and 28.0: Sustainable Property Guides/Best Practices.

Another key source of sustainable features ideas and insights are case studies. Most of the case studies performed to date are sufficient for use in identifying and screening ideas, but are not sufficiently detailed or financially oriented to be used effectively for property specific financial analysis.

A description and assessment of some important case-study databases is presented in Appendix III-B and at:
(http://www.greenbuildingfc.com/Home/Reports.aspx) I also like the Case Studies presented in the RICS Green Value Study completed in 2005 because they provide good

detail, include interviews with tenants and owners where possible, and begin to focus on valuation and financial performance issues: (http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=121). A summary of these interviews is presented in Expanded Chapter IV, Appendix IV-B. More detail on case studies is available in the Research Library (15.2) and Industry Resources (15.2) sections of the Consortium's website. (http://www.greenbuildingfc.com/Default.aspx)

There are lists and menus at varying levels of detail and specification. The one list that is not available is the precise list of strategies and features appropriate for "your" property. That list will have to be determined through an integrated design/values process where you meet with the relevant stakeholders to decide what it is you value and how you want to pursue those values through sustainable design, construction and property operations.

The selection of documents and websites cited below is a sample of some sources we have found particularly useful to understanding the sustainable features and options available to sustainable property investors. Given the rapid growth in these types of resources, the web sites of key trade groups serving developers, investors, corporate real estate professionals, property type specialists, and key service providers like architects and engineers should be regularly consulted for the latest information. The resources below are weighted to North America, but are valuable for anyone evaluating sustainable buildings. Country and region specific resources should also be consulted.

Whole Building Design Guide: http://www.wbdg.org/about.php

The WBDG is the only web-based portal providing government and industry practitioners with one-stop access to up-to-date information on a wide range of building-related guidance, criteria and technology from a 'whole buildings' perspective. Currently organized into three major categories—Design Guidance, Project Management and Operations & Maintenance—at the heart of the WBDG are Resource Pages, which provide summaries on particular topics.

Development of the WBDG is a collaborative effort among federal agencies, private sector companies, non-profit organizations and educational institutions. Its success depends on industry and government experts contributing their knowledge and experience to better serve the building community.

The WBDG web site is offered as a service to the building community by the National Institute of Building Sciences (NIBS) through funding support from the Department of Defense, the NAVFAC Engineering Innovation and Criteria Office, the Army Corps of Engineers, the U.S. Air Force, the U.S. General Services Administration (GSA), the Department of Veterans Affairs, the National Aeronautics and Space Administration (NASA), and the Department of Energy, with the assistance of the Sustainable Buildings Industry Council (SBIC). A Board of Directors and Advisory Committee, consisting of representatives from over 25 participating federal agencies guide the development of the WBDG.

ASHRAE Green Tips:
http://www.engineeringforsustainability.org/docs/greentips_2006.pdf

ASHRAE identifies and describes 30 tips for implementing sustainable development. These tips cover key sustainable features and lay out strategies for implementation, cost considerations, and other resources to review.

ASHRAE Guides: http://www.ashrae.org/publications/

ASHRAE publishes a number of useful guides. The most specific to sustainability is the ASHRAE Green Guide, Design, Construction and Operation of Sustainable Buildings, 2006. This 390-page guide provides detailed descriptions and assessments of a broad array of sustainable features, processes, and strategies. This publication is available at a relatively small price.

Another good guide that is freely available is ASHRAE's Advanced Energy Design Guide.

New Buildings Institute Core Performance Guide, July 2007
http://www.advancedbuildings.net/corePerf.htm
The *Core Performance Guide* offers a simplified approach to achieve predictable energy savings in small-to-medium-sized commercial buildings—without the need for energy modeling. This document brings together over 30 criteria defining high performance in building envelope, lighting, HVAC, power systems, and controls. With this easy-to-use tool, building design and construction professionals will be able to establish clear targets and implement strategies to cost-effectively reduce energy use in new buildings by 20-30% compared to ASHRAE 90.1-2004. There are also special editions for the state of Vermont, New Brunswick and one in process for the state Oregon.

In general, the *Core Performance* requirements are most appropriate for new buildings and major renovations ranging from 10,000-70,000 square feet for offices, schools, and retail, but you can apply the concepts to projects of any size and building type.

Green Rehabilitation of Multifamily Rental Properties and Green Operations and Maintenance, Guide and Toolkit, Bay Area LISC and Build it Green, 2008
http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=854
http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=856

These are good practical guides to developing and operating sustainable multi-family properties.

YourBuilding.org, Australia
http://www.yourbuilding.org/display/yb/Home

One of the best sustainable building websites in the world specifically designed for investors, developers, space users, valuers and other private sector participants. This site is

very rich with detail across many aspects of design, valuation, marketing and many other key areas. Most importantly, it is intelligently organized around terms and categories that will ring true to real estate industry participants..

Better Bricks.com, Northwest Energy Efficiency Alliance, USA
http://www.betterbricks.com/

This is another excellent all around website notable for its organization around property types, separating operations from design and construction, and practical easy to use functionality. Many excellent resources including the High Performance Portfolio Framework which provides some insights on the process of moving towards greater energy efficiency/sustainability from the perspective of owners, users, and other private real estate participants. http://www.betterbricks.com/DetailPage.aspx?ID=673

BuildingGreen.com
http://www.buildinggreen.com/menus/topics.cfm

This is an excellent well-organized web site with an excellent bibliography, searchable product database and a "Learning Center" with links to many lists of key sustainability features and articles. This site is also the home of one of the largest case study databases in the industry.

BOMA International Green Resources and Energy Efficiency Network
http://www.boma.org/BOMA/Templates/Org/GeneralTemplate.aspx?NRMODE=Published&NRORIGINALURL=%2fAboutBOMA%2fTheGREEN%2f&NRNODEGUID=%7bBB26487D-2B2D-45D7-8876-E8A1DBF7E496%7d&NRCACHEHINT=NoModifyGuest#

This site has numerous sustainability resources including 30 easy ways to save energy.

International Council of Shopping Centers Sustainability Portal
http://www.icscseed.org/event/icsc-retailgreen-conference-and-trade-exposition

Many resources including link to a green retail best practices database sponsored by Greening Retail.

Lawrence Berkeley National Laboratories Energy and Environmental Technologies Division
http://eetd.lbl.gov/r-bldgsee-cb.html

This website provides access to scores of interesting studies and guidance on energy, Indoor Environmental Quality (IEQ), and related sustainability topics.

American Institute of Architects, Best Practices Guides
http://www.aia.org/bestpractices

Extensive collection of writings on a broad array of architectural best practices with many sustainability topics covered in areas including contracts, design, etc.

Natural Resources Defense Council
http://www.nrdc.org/buildinggreen/strategies/default.asp

Strong website with well-organized practical suggestions for sustainable building.

UC Berkeley Center for the Built Environment Studies
http://www.cbe.berkeley.edu/research/publications.htm

The Center's projects fall into two broad program areas: First, their research team and industry partners are developing ways to "take the pulse" of occupied buildings--looking at how people use space, asking them what they like and don't like about their indoor environment, and linking these responses to physical measurements of indoor environmental quality. This feedback is highly valuable for those who manage, operate, and design buildings. Secondly, they are studying technologies that hold promise for making buildings more environmentally friendly, more productive to work in, and more economical to operate. This helps the center's manufacturing partners to target their product offerings, and facility management and design partners to apply these new technologies effectively.

Whole Building Integration for Commercial Buildings and Commercial Building Design and Performance, National Renewable Energy Laboratory
http://www.nrel.gov/buildings/comm_whole_building.html
http://www.nrel.gov/buildings/comm_building_design.html

Two excellent websites with substantial detailed information on many features and processes.

DOE Energy Efficiency Toolkit
http://www.eere.energy.gov/buildings/highperformance/toolbox.html

Excellent site covering all aspects of energy planning and implementation.

Flex Your Power, State of California
http://www.fypower.org/about/

Flex Your Power is California's statewide energy efficiency marketing and outreach campaign. Initiated in 2001, Flex Your Power is a partnership of California's utilities, residents, businesses, institutions, government agencies and nonprofit organizations working to save energy. The campaign includes a comprehensive website, an electronic

newsletter and blog, and educational materials. Flex Your Power has received national and international recognition, including an ENERGY STAR Award for excellence.

24 No-Brainers for your Next Project, Alan Whitson, Building Design and Construction, November 2006.
http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=962

The title says it all. This is a quick checklist of issues to consider based on Mr. Whitson's substantial experience in the field. His presentations "Green to Gold," "Lighting for Profit," and others provide significant detail on sustainable features with some of the most direct and practical advice regarding cost-benefit implications in the market today.

Carnegie Mellon School for Architecture, Center for Building Performance and Diagnostics http://www.arc.cmu.edu/cbpd/iw/iw_about.html

This site provides a listing of some of the key features for the structure, enclosure, interior, lighting, controls, connectivity, and HVAC. The Center has much more information, including their BIDS system, which has the most complete and organized assessment of building related scientific studies influencing the workplace that I have seen, but it is not generally available except to financial supporters of the Center.

Carnegie Mellon's BIDS, Building Investment Decision Support, is a case-based decision-making tool that calculates the economic value added of investing in high performance building systems based on the findings of building owners and researchers around the world. The framework of multiple life-cycle variables to cost justify key design innovations within a rich data base of international case studies, and the EVA/NPV calculator that incorporates a range of financial assumptions linked to international organizations, is fully patented by U.S and Pennsylvania law as well as legally adopted by all Advanced Building Systems Integration Consortium (ABSIC) members.

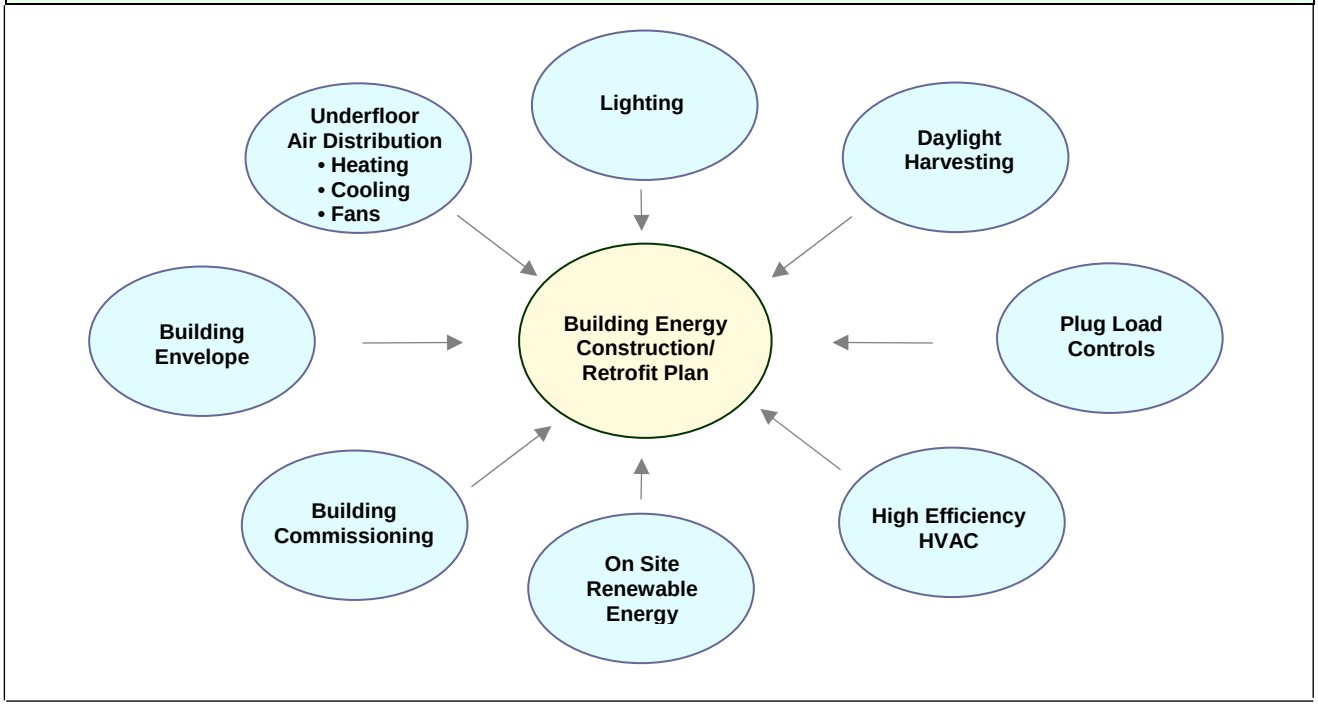
3. Sustainable Property Features and Building Outcomes

A sustainable features based approach to understanding sustainability is a good first step, and necessary to financial analysis, but it is the eventual measurement of building outcomes/performance that will have the greatest long-term effect on financial performance. As shown in Exhibit III-3 below, there are at least eight major "features" to employ in developing a building energy construction or retrofit plan: lighting, daylight harvesting, plug load controls, building envelope improvements, high efficiency HVAC, on-site renewable energy, under-floor air distribution, and building commissioning. These can produce varying combinations of features/strategies:

- **Lighting**: Design lighting to occupant and task; maximize fixture, lamp and ballast efficiency; use automatic controls, high efficiency light bulbs, LED lighting, occupancy sensors, timers.

- **Daylight harvesting**: Windows, skylights, clerestories (vertical windows placed at or near the top of exterior walls), and monitors (stepped roof combined with clerestories), daylighting controls.
- **Plug load controls**: Efficient vending machines, EnergyStar copiers, faxes, and printers.
- **High efficiency HVAC**: "Right size" equipment, high efficiency components, energy efficient motors, various speed drives, improved controls, economizer strategies.
- **On-site renewable energy**: Photovoltaic systems, passive solar systems, geothermal heating/cooling systems.
- **Building commissioning**: Verification and testing of systems and performance.
- **Building envelope**: Light or reflective roofs, double- or triple-glazed windows, shading strategies, shading projections, interior shading devices, high-performance glazing.
- **Underfloor air distribution**: Floor by floor air handling units, thermal insulation of decks, etc.

Exhibit III-3
Strategies to Improve Energy Efficiency



The key point illustrated by Exhibit III-3 is that, depending on the features chosen, and the specific strategy employed for a particular property, there are many different ways to achieve building energy efficiency. In developing a building energy or construction/retrofit plan, it is also important to take a holistic approach, explicitly

evaluating the many interrelationships among energy efficiency strategies. For example, the level and type of lighting, or daylighting, will have significant implications for heating, cooling and thermal comfort. The overall projected energy use will affect the size of the HVAC system required.

Process issues are also critical to determining the best mix of sustainable features for a property. Critical to potential energy performance is getting electrical engineers and building operations people involved early to provide appropriate input. Experienced building commissioners can also provide value from the start of a project, rather than just performing a test at the end.

Again, from a financial perspective, the best way to deal with all the complexities of the various features is to focus on actual building performance. The problem with this strategy is that so much of sustainable investment involves forecasting how changes or additions to the sustainable features in the building will change the energy or water use. Accordingly, underwriters and appraisers will need to conduct their due diligence using energy performance forecasts prior to getting actual building performance data in many cases. We will address this issue in detail in Chapter VI, Section E: "Underwriting Energy-Carbon Reduction Investment."

D. Measuring a Property's Sustainability

1. Financial Analysis Requires Broad Knowledge of Alternative Approaches

Measuring property sustainability is critical to financial analysis and valuation. The challenge is that there is literally hundreds of sustainability assessment and certification systems in use today. In this section we identify, categorize, and evaluate existing sustainability assessment and certification systems to aid in the financial analysis discussed in more detail in later sections.

While we understand the substantial number and complexity of systems can be daunting, a specific property will have a unique geography, property type, life cycle, and other attributes that will enable readers to select a more limited number of rating and assessment systems applicable to their situation.

For the purposes of a financial analysis, it is important to understand the range of assessment systems and tools that are in use or under development. In market-based financial analysis or valuation, numerous certification and assessment systems will typically be applied to a single property. To determine which certification and assessment systems are important for a single property, the underwriter/valuer must evaluate how regulators, users and investors utilize and rely upon different assessment systems or tools.

Sustainable property certification and assessment systems come in many forms as shown in Exhibit III-4. In order to aid evaluation and understanding of these alternative

approaches, we organize the many measurement and certification systems into six categories:

- Building environmental assessments and certifications;
- Occupier focused assessments;
- Government regulations and assessment systems;
- Other building performance assessments and standards;
- Product/material assessments and certifications; and,
- Service provider assessments and certifications.

Exhibit III-4
Six Categories of Sustainability Measures

	Type	Level	Examples	Comments
1.	**Environmental assessments**	Building	LEED, BREEAM, GreenStar, CasBEE	Whole building assessments focused on measurement of environmental performance as measured by actual or modeled (as designed) performance. Output of assessments typically not easily comparable or tied to underlying building sustainability features or attributes
2.	**Occupier-focused assessments**	Building; company	Global Reporting Initiative, IPD Environmental Code, Leased Space Leadership Consortium Guidelines	Specialized whole building assessment of reporting systems identified by owner-occupiers as having particular influence on their real estate decisions. Broad environmental assessment systems like LEED are often cited in the context of these specialized assessment methodologies.
3.	**Government regulations/ codes/ incentives**	Building; building features; products; procurement	European Directive on the Energy Performance of Buildings, Local government initiatives	Federal, state, local, and other levels of government and quasi-governmental (utilities) agencies define, measure and require widely differing levels of sustainability in private sector buildings.
4.	**Other building performance assessment standards**	Building; building features	ASTM Sustainability Standards, International Standards Organization (ISO/TS:21929 1:2006), ASHRAE Guidelines	Many national and international organizations have developed measurement systems and standards for building performance, including sustainability outcomes.
5.	**Product/material assessments/ certifications**	Products, materials, features	GreenGuard, Green Seal, Forest Stewardship Certification	There are scores of rating, assessment and certification systems for various sustainable building products and materials that are often incorporated as part of broader whole building rating or assessment systems.
6.	**Service provider certifications/ assessments**	Companies; individuals	ASHRAE Certifications, Green Building Certification Institute, LEED AP	There are a growing number of organizations that are identifying, and in some cases, certifying service providers on their sustainability expertise. True independence and rigor in certification of expertise should be required prior to reliance on such certifications.

Building environmental assessments and certifications include some of the most recognized "green" building certifications like LEED, BREEAM, CASBEE, and GreenStar. These certification approaches typically have separate certifications for different stages of the property life cycle—new, existing, and commercial interiors—and generally cover all aspects of sustainability. A comparison of five systems—LEED USA,

LEED Canada, Green Globes, Go Green Plus, and SBTool prepared by the iiSBE is shown in Appendix III-C presented at the end of this chapter. [13]

Occupier focused assessments, such as the Global Reporting Initiative or the IPD Environmental Code, are specialized whole building assessments that have particular influence on the real estate decisions of tenants and owner occupants. Understanding the specifics behind the motivations of tenants and owner-occupiers is critical to assessing the potential implications of sustainability on financial performance.

Government regulations and incentives cover literally thousands (there are 44,000 local governments in the U.S. alone) of regulations, incentives, codes and related assessment systems being promulgated by Federal, State, local and other levels of government and quasi-governmental agencies such as utilities.

Other building performance assessments and standards include a variety of systems focused on building outcomes and performance, as opposed to just environmental certification. The approaches identified here are supplemented by countless other approaches and systems that have been and are currently under development. Measuring, monitoring and management of sustainability is key to maximizing potential value.

Beyond building assessment systems, there are scores of **product and material assessments and certifications**. Many of these product, material or feature certifications are incorporated as part of the broader whole building rating systems such as LEED. The challenge with these product or material rating systems is to find sources of information that have sufficient funds, independence, and technical expertise to provide useful comparative information. Greenwashing—the practice of making sustainability claims that are not backed up or are overstated—is prevalent in the industry and will be a continuing concern.

Product rating systems, like the Cradle to Cradle® product certification system, a private eco-labeling system launched in 2005 which had over 300 products certified as of Fall 2009, provide a reasonably consistent methodology for evaluating products and can help owners and designers in their product selection, but they only rate products who seek them out and pay them, so the number of products reviewed is just a fraction of the total available.

Companies like BuildingEase.com are entering the product and materials space and should improve the process of sustainable product selection and acquisition. BuildingEase.com is a global trade exchange for construction products, designed to be like Amazon.com/eBay/Expedia, but only for the construction industry. It endeavors to be a comprehensive source of products and materials worldwide. They have created a

[13] Jean Cinq-Mars, Joel-Ann Todd, Gary Sharp, and Nils K. Larsson, "A Study of Green Building in North America, Phase 1: Background, History, Issues and National Overviews," carried out for the CEC Secretariat by The International Initiative for a Sustainable Built Environment, May 30th, 2006

proprietary green filter so search results will appear filtered by how green their attributes are, as well as with side by side comparisons, user feedback ratings, distance from job site and other information. The site is also designed to facilitate aggregate bidding. [14]

Integrating Life Cycle Assessment practices, which measure the embedded energy/carbon required to produce a product, is also an important part of new product rating databases. Given the huge amounts of investment, job implications, etc. of a negative review of a product or system, good information is still hard to find.

Finally, there are a growing number of organizations that identify, assess, and **certify service providers** such as contractors, plumbers, electricians, commissioners, and other professions on their sustainability expertise. The credibility and rigor involved with these different groups is highly variable. The key here is to understand explicitly the requirements for certification and/or listing in the directory and use the list accordingly. Even if a list requires no special requirements other than interest in sustainability, it could be useful.

It should also be noted, that given the penetration of sustainability through every aspect of building design, construction and operations, sustainability training is now integrated into the general education requirement for many professional certifications.

Two interesting developments in the certification and assessment of sustainable companies are the B-Corporation and the Sustainable Performance Institute's Green Firm Certification. Both these efforts aim at enhancing the independence and credibility of firm claims of sustainable operating practice and/or competence.

B Corporations are designed to address two problems, which hinder the creation of social and environmental impact through business:

- The existence of shareholder primacy which makes it difficult for corporations to take employee, community, and environmental interests into consideration when making decisions; and

- The absence of transparent standards, which makes it difficult to tell the difference between a "good company"' and just good marketing.

A B Corporation's legal structure is designed to expand corporate accountability and enable them to scale and achieve liquidity while maintaining mission. B Corporations' performance standards are designed to enable consumers to support businesses that align with their values, investors to drive capital to higher impact investments, and governments and multinational corporations to implement sustainable procurement policies.
http://www.bcorporation.net/why

[14] The author has not done significant verification of the site's claims, but mention this site because its aspirations and proposed approach are important indications of the direction of product and material solutions to the problems of green washing and product and material overload.

The Sustainable Performance Institute (SPI) certification program is designed to improve design and construction organizations' ability to manage and deliver sustainable projects by monitoring and certifying their consistent use of processes that consistently result in sustainable building design and construction. SPI certification will examine an organization's performance through documentation of its:

- Strategy, policies, infrastructure and leadership
- Production processes, e.g., schematics, design development, construction administration, etc.
- Support processes, Human Resources, Marketing, Internal design/spec standards, Tools and Resources.
- Partnering, e.g., proposals, contracts scope/fee change, deliverables and working relationships with stakeholders.
- Outcome measures of its own environmental footprint and its projects' performance

Over a hundred certification and assessment systems from around the world are identified in Appendix III-D and categorized according to the six categories described in Exhibit III-4. A brief description and web link to more detailed information is provided in this Appendix for each of the systems identified. Since the bulk of Appendix III-D was created, the United Nations Environmental Programme, Sustainable Buildings and Construction Initiative published a report: UNEP-FI/SBCI's Financial and sustainability Metrics report which updates Appendix III-D with additional performance and certification programs. This report is well done and outlines common performance indicators for sustainable building, discusses in detail key financial indicators for sustainable buildings, and does a comparative assessment of six key certification systems and describes many more. http://www.unepfi.org/publications/property/index.html

2. Performance Measurement Moves to Forefront in Industry

Measurement and assessment is at the forefront of the private sector commercial real estate industry today. As corporate boards, pension boards, and other senior management have declared their commitment to looking closely at sustainable issues in their real estate, portfolio managers, corporate real estate executives, and facility and property managers are struggling to determine what level of sustainable performance they should strive for, how sustainable their properties are today, and what they need to do to better measure, monitor, and manage sustainability going forward?

There are many ways to think about measurement and certification systems. One of the most important for financial analysis is the difference between certification or assessment systems based on modeled criteria versus those based on actual performance (water use,

energy use, carbon output, quality of the indoor environment, etc.). For certification or assessment systems based on modeled criteria, underwriters need knowledge and expertise on how to assess the accuracy and reliability of forecasts. For systems based on actual performance, key issues include selecting the correct items to measure, accurately measuring them, and employing a consistent approach between properties to enable comparisons.

The sustainable property industry has matured resulting in an increasing focus on actual versus projected performance. However, depending on whether you are in the planning, construction, or operations phase of a building, and on the specific sustainable features and attributes planned, different assessment and certification systems may be more applicable and appropriate.

Building codes and government regulations are typically more prescriptive, specifying specific requirements in the hopes of easing compliance enforcement by local building officials and the public and ensuring consistency. With the development and maturity of performance-based environmental certifications like LEED, many governments have incorporated such environmental certifications into codes and regulations. This trend is likely to change in future years as minimum prescriptive standards for high performance buildings are better defined.

We dedicate Chapter IV: "Sustainable Property Performance," to the presentation of GBFC's new Sustainable Property Performance Framework and an assessment of sustainable property performance evidence.

3. Select Developments in Certification and Measurement[15]

ASTM Building Performance and Energy Disclosure Task Force

This committee of 171 specialists from around the United States is working on an ASTM standard (WK24707) titled: Standard Practice for Building Energy Performance Assessment and Disclosure on a Building Involved in a Real Estate Transaction. This is an important effort in that it is being pursued from a practical perspective building off other work done in this area by many other organizations. The Purpose and Objectives as outlined in the draft standard are shown below:

1.1 *Purpose*—The purpose of this practice is to define good commercial practice in the United States of America for conducting a *Building Energy Performance Assessment (BEPA)* on a building involved in a *real estate transaction* and disclosure of the *building energy performance* information. This practice may be used independently or as a voluntary supplement to ASTM Standard E 2018 for *Property Condition Assessments*.

[15] This section discusses only a sample of some key developments, with a focus on investor/tenant related developments. In fact, all of the 100 or more certification and assessment systems identified in Appendix III-C represent important efforts to bring clarity to what a "sustainable property" is.

This practice is intended to permit a user to satisfy "*all appropriate disclosure"* regarding the *energy performance* of the building consistent with prevailing industry standards and applicable local regulations.

1.3 *Objectives* – Objectives in the development of this standard practice are to: (1) define good commercial and customary practice for collecting and disclosing *energy performance* information associated with a commercial building involved in a *real estate transaction*; (2) facilitate consistency in the collection and reporting of *building energy performance* information; (3) to supplement a *Property Condition Assessment* conducted in accordance with ASTM E 2018; (4) to ensure that the process for *building energy performance* data collection, analysis and reporting is practical and reasonable; and (5) to provide an industry standard for the conduct of a *BEPA* on a building involved in a *real estate transaction*.

European Union Energy Performance in Buildings Directive: 2009 Recast

The Directive on Energy Performance in Buildings (EPBD), adopted in 2002, is the main legislative instrument affecting energy use and efficiency in the building sector in the EU. The Directive tackles both new build and the existing housing stock. Significant knowledge has been gained over the last 7 years—particularly on the issues of enforcement and implementation, and a new "Recast" of the Directive was announce in a political agreement passed by the European Union on November 17th, 2009. http://www.eceee.org/buildings .

Major Highlights of the Political Agreement include:

- As of 31 December 2020 new buildings in the EU will have to consume 'nearly zero' energy and the energy will be 'to a very large extent' from renewable sources.

- Public authorities that own or occupy a new building should set an example by building, buying or renting such 'nearly zero energy building' as of 31 December 2018.

- The definition of very low energy building was agreed to: "nearly zero energy building means a building that has a very high energy performance, determined in accordance with Annex I. The nearly zero or very low amount of energy required should to a very significant level be covered by energy from renewable source, including renewable energy produced on-site or nearby"

- There is no specific target be set for the renovation of existing building, but Member States shall following the leading example of the public sector by developing policies and take measures such as targets in order to stimulate the transformation of buildings that are refurbished into very low energy buildings, and inform the Commission thereof in their national plans referred to in paragraph 1.

- The 1000m2 threshold for major renovation has been deleted and this will take effect when the national regulations have been implemented and applied, probably at the beginning of 2014.

- Minimum requirements for components are introduced for all replacements and renovations, although for major renovations, the holistic calculation methodology is the preferred method with performance calculations based on component requirements allowed as a complement or alternative.

- A harmonized calculation methodology to push-up MS minimum energy performance requirements towards a cost-optimal level is set out in the Directive in a definition and an annex, and will also be refined in a comitology process,. MS will have to justify to the COM if the gap between current requirements and cost optimal requirements is more than 15 %.

- A more detailed and rigorous procedure for issuing energy performance certificates will be required in MS.

- Control systems will be required by MS to check the correctness of performance certification.

- MS will be required to introduce penalties for non-compliance. Member States shall lay down the rules on penalties applicable to infringements of the national provisions adopted pursuant to this Directive and shall take all measures necessary to ensure that they are implemented. The penalties provided for must be effective, proportionate and dissuasive. Member States shall communicate those provisions to the Commission.

ULI Energy Exchange Initiative

ULI Europe's research team is leading a new sustainability project, the ULI Energy Exchange Initiative (EEI), endowed by Sir Stuart Lipton, 2007 winner of the J.C.Nichols Prize for Visionaries in Urban Development and a longstanding ULI trustee. Working in partnership with Arup, a global engineering, design, planning, and consulting firm, ULI Europe is developing a web-based information exchange that will allow industry leaders to get access to and share practical, current information and best practices in energy efficiency, particularly for existing buildings.

An initial survey has already been sent to all European ULI members to gauge what information is needed, and Arup held a practitioner workshop in early April to draw out the key themes that need to be addressed. To discuss or contribute to this new initiative, contact Alexandra Notay, research director, at anotay@uli.org, or Josie Baum, research intern, at jbaum@uli.org.[16]

[16] *Urban Land Green*, Spring 2009.

International Green Construction Code

In June 2009, the American Institute of Architects, the International Code Council (ICC) and the American Society for Testing and Materials (ASTM), announced their intent to create an International Green Construction Code (IGCC). The key reason stated for the code was a need for a clear and enforceable code. The new code aims to cover all aspects of sustainability in the built environment, from roofing to ventilation strategies, drawing from existing codes and standards to create one universal code. The code will apply to new construction and renovations.

A 29-person drafting committee—made up of a broad range of stakeholders—is referring to an ASTM database of existing green codes and standards to help draw up the code and identify any holes. The committee is working closely with the group responsible for Standard 189P a major initiatives already being developed by the U.S. Green Building Council, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, and the Illuminating Engineering Society of North America.

The code will be a model code requiring adoption by a governing jurisdiction before becoming law. A key part of the code is its ability to integrate with the health and safety features of existing codes.

The first draft of the code is expected in March 2010 with a series of public commentary and related steps leading to final action hearings in Fall 2010.

IPD Environmental Code

In early 2008 the Investment Property Databank (IPD) launched a global initiative to help real estate owners measure and understand the environmental impact of their buildings. The IPD code is designed for both tenants and landlords, anywhere in the world, to measure carbon emissions of any type of building through the collection of core measures—water, energy, etc.—and qualitative measures. IPD officials estimate it may take as long as three years to collect data on each building, and further refinement is expected when the Code's content is reviewed in 2010.[17] More information on the IPD Code can be found at:
http://www.ipd.com/Home/GlobalEstateMeasurementStandards/%20Measuringenvironmentalimpacts/IPDEnvironmentCode/tabid/1632/Default.aspx

Leased Space Environmental and Energy Leadership Group

The Leased Space Environmental and Energy Leadership Group is a group of corporations who have organized to promote the availability of competitively priced leased spaces that provide energy efficiency and environmental benefits. Key companies involved include IBM, Citi, Cisco, Chase, PWC, Pitney Bowes, Fluor Corporation, Grubb & Ellis, Wachovia, and Dupont.

[17] IPE.com, February 28, 2008

The group was formed because of the lack of sustainable energy-efficient space around the world. While the group endorses the LEED standard, they are clearly interested in, and will lease space from, buildings that meet a minimum set of standards they have developed. "*Just because a building is not LEED certified does not mean that there are not energy and environmental attributes that are important to users"*.

The group has developed a consensus checklist of attributes they require in a property to be leased. They plan to require this checklist in all RFP's for leased space. One of the most critical issues is separate meters so they can accurately measure carbon output/energy use and the effect of investments they make to reduce carbon output/energy use. Leasing has become much more important in recent years as large corporations like IBM have moved from 30% leased space to over 60%.[18]

Office of the Future Consortium

The Office of the Future (OTF) is a consortium of some of North America's largest energy utilities committed to finding new ways to address energy efficiency in the commercial buildings market. As public policies to address global warming and rising energy costs are strengthened, new ways to deliver energy efficiency programs are needed—efforts that incorporate increased comprehensiveness of treatment, use of integrated design strategies, changes in operational patterns, and upstream work with product manufacturers to create deeper, more robust energy and demand savings from the office market.

Southern California Edison initiated OTF as a multi-utility effort to develop additional savings opportunities in the office market. Offices are the largest market segment in the commercial sector, and energy usage has been relatively flat in existing offices for many years as advances in energy codes and energy-related technologies are offset by countervailing trends of increased office equipment energy use and increased intensity of space utilization.

Following initial technical research, a working paper entitled "The 25% Solution" was developed. This paper describes a package of measures and design strategies that provide a 25% energy use reduction compared to code levels of Title 24 for California and ASHRAE 90.1-2004 for the rest of the country. (Savings compared to typical existing office baselines would be significantly larger.)

At the same time the 25% technical solutions are being piloted, the OTF Consortium is looking for mechanisms to reach 50% (or greater) energy savings compared to code baselines. Development of the 50% solution set will require innovation in lighting, control and HVAC, with the potential for other energy saving elements within the office work space. [19]

[18] Presentation of Bruce Sargent, NAIOP Meeting, March 12, 2008.

[19] David Hewitt, "Office of the Future Consortium: Advanced Energy Office Program and 50% Solution Development," New Buildings Institute, June 30, 2009.

"Green Rating" System

In Europe, a new international "Green Rating" system has been developed by a group of large investment managers including ING Real Estate, GE Real Estate Europe, AXA REIM and AEW Europe. They teamed with French certification and inspection group Bureau Veritas to develop the system for property investments to serve a need they see as unmet by existing green labels, most of which are country-specific, harder to implement, and focused on new buildings.

The GGR is intended to assess and benchmark the environmental performance of existing buildings by a number of measurable indicators including energy and water consumption, waste production, carbon emissions, public transportation, and occupier health and safety. The rating will be assessed on site by a third party. A key aspect of the rating is to provide building benchmarks to monitor ongoing improvements and allow easier property comparison across countries.

The "Green Rating" system was launched in Spain in April 2009 and will be launched in France, Italy, the Netherlands and Germany in 2009. In 2010, it is expected to be launched in the US and Japan. Around 120 buildings will be audited in Europe in 2009.

ASHRAE's Building Energy Labeling Program

The Building Energy Quotient program, which will be known as Building EQ, will include both asset and operational ratings for all building types, except residential. ASHRAE is working with major real estate developers to implement the label prototype in the fall of 2009 with a widespread launch of the full program in 2010. For more information, see http://buildingEQ.com/.

The ASHRAE labeling program differs from existing labeling programs in that it focuses solely on energy use. Under the ASHRAE program, new buildings will be eligible to receive an asset rating. An operation rating will be available once the building has at least one year of data on the actual energy use of buildings. Existing buildings would be eligible to receive both an asset and operational rating.

ASHRAE released the prototype building energy label at its June 2009 annual meeting. The objective of ASHRAE's building labeling effort is to encourage reduced energy use in commercial buildings by expressing the energy performance of buildings in a tangible way. Commercial buildings are defined as those buildings covered by the scope of ASHRAE/IESNA Standard 90.1.

The purpose of the label is to:

- Provide a meaningful summary of a commercial building's energy performance that can be disclosed or presented to parties engaged in real estate transactions with a comparison to ASHRAE 90.1.

- Provide an energy efficiency rating that facilitates the comparison of buildings' performance.
- Provide an energy efficiency rating based on a building's design and its estimated energy consumption.
- Provide an energy efficiency rating for a building's actual energy consumption and operation.
- Provide meaningful indicators of the building's impact on the environment such that the greenhouse gas emissions can be estimated.
- Document major energy efficiency features and characteristics of the building.
- Evaluate the building's design intent to meet or exceed minimum indoor environmental criteria for health.
- Provide recommendations for energy efficiency improvements. [20]

These metrics will be used to guide the development of the ASHRAE Building Energy Label.

This effort by ASHRAE could be an important step in improving the integration of energy efficiency into financial decision-making. By improving the consistency of measurement, making the results visible, and expanding the reach of the EnergyStar label to more property types and to other countries, the labeling program has the potential to be important. Other important initiatives include the development of certification programs for "Qualified Energy Modelers" and "Qualified Energy Assessors" and a planned smooth rollout that builds on the success of EnergyStar. The benefits of labels should not be over-stated, given the inherent limitation of energy use in the overall decision to lease, buy or renovate a building.

SBTool 07[21]

SBT07 is a product of the International Initiative for a Sustainable Built Environment (iiSBE), http://www.iisbe.org/iisbe/sbc2k8/sbc2k8-download_f.htm. The SBTool 07 provides a generic toolkit that any local organization can use to develop a rating system. Like many sustainable assessment systems, SBTool has improved and evolved over time, and continues to be improved and adapted by various regional organizations to accomplish different objectives. The tool has the ability to take into consideration national, regional, and bioclimatic differences, and allows users to adjust the weighting of strategies based on specific national or regional priorities and local climate data or occupancy.

SBTool provides a generic framework for rating the sustainable performance of buildings and projects. It may also be thought of as a toolkit that assists organizations to develop

[20] ASHRAE Building Energy Labeling Program, Report of an ASHRAE Presidential Ad-Hoc Committee, June 2008.

[21] Quantifying Sustainability: A Study of Three Sustainable Building Rating Systems and the AIA Position Statement, AIA Sustainability Discussion Group, May 2008.

rating systems. The system covers a wide range of sustainable building issues, not just green building concerns. The scope of the system can be modified to be as narrow or as broad as desired, ranging from a half-dozen to 125 criteria. The system allows third parties to establish parameter weights that reflect the varying importance of issues in the region, and to establish relevant benchmarks by occupancy type, in local languages. Thus, many rating systems can be developed in different regions that look quite different, but share a common methodology and set of terms. The main advantage, however, is that an SBTool version developed with local knowledge is likely to be much more relevant to local needs and values than other systems.

Although the current version is set up to carry out design-stage assessments only, the system has the capacity to carry out assessments at four distinct stages of the property life cycle.[22]

Responsible Property Investing[23]

Responsible Property Investing (RPI) has been linked with sustainable property investment since its introduction into the mainstream real estate industry lexicon with the publication of "Responsible Property Investing" in the *International Real Estate Review* in 2005[24]. RPI principles have been adopted by the United Nations Environmental Programs Finance Initiative Property Working Group. The linkage of the two concepts results from sustainable property investing, and related energy and water conservation, being three of the ten key investment sectors of RPI, and the coincidental dramatic emergence of Sustainable Property Investment in the private sector at the same time. The recently formed Responsible Property Investing Center provides good access to much of the important historic research and resources on the topic: http://www.responsibleproperty.net/pa/ge/who-we-are/steering-committee.

RPI is the real estate specific outgrowth of a variety of historic worldwide movements promoting socially responsible investment as discussed in Pivo and McNamara's "Responsible Property Investing" :

- The Equator Principles which commit its adopting institutions to only supporting projects that have a complete Environmental Assessment and address key social and environmental issues including compliance with the International Finance Corporation and World Bank Guidelines and Safeguard Policies;
- The Global Compact, which asks participating companies to act in accordance with human rights, fair labor practices, environmental protection, and anti-corruption practices;

[22] iiSBE website, August 2008.

[23] Much of the discussion below was extracted directly from the August 2008 report "Responsible Property Investing, What are the Leaders Doing?" published by the UNEP Finance Initiative Property Working Group http://www.unepfi.org/work_streams/property/ .

[24] Gary Pivo and Paul McNamara, "Responsible Property Investing," *International Real Estate Review*, 2005. http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=138

- The International Finance Corporation's (IFC) environmental health and safety guidelines for office buildings and tourism developments that set standards for siting, liquid effluents, stack emissions, solid and liquid wastes, life and safety issues, and avoidance of natural hazards;
- The IFC's safeguard policies on cultural property, involuntary resettlement, and natural habitats;
- The World Bank's General Environmental Guidelines and pollution guidelines on industrial estates;
- The International Organization for Standardization's environmental management standard (ISO 14000) on what a firm should do to minimize harmful effects on the environment caused by its activities and to achieve continual improvement of its environmental performance; and,
- Recommendations by the Institutional Investors Group on Climate Change, the Carbon Disclosure Project, and others that are encouraging the reporting of investment-relevant information on greenhouse gas emissions by private companies.

RPI is complex to assess from a financial performance perspective except on a general basis because of the numerous different sectors of real estate investing involved, each of which requires special expertise and underwriting guidelines. To date, the focus of RPI has been on evaluating and making the case for how RPI investments can offer comparatively equivalent or higher positive returns versus similar non-RPI investments.

From the perspective of sustainable property underwriting and valuation, the most important implication of the RPI movement is the strong interest institutional investors are showing in the concept, and the potential for an increase in capital to certain sustainable property investments, potentially reducing capitalization rates and discount rates, and thus increasing values. These positive impacts will need to be determined on a property-by-property basis.

While literally scores of different types of investments have been identified as candidates for RPI, the following ten sectors were identified in the August 2008 UNEP Report:

- **Energy conservation**: conservation retrofitting, green power generation and purchasing, energy efficient design;
- **Environmental protection**: water conservation, solid waste recycling, habitat protection;
- **Voluntary certifications**: green building certifications;
- **Public transport oriented developments**: transit-oriented development, walkable communities, mixed-use development;
- **Urban revitalization and adaptability**: infill development, flexible interiors, brownfield redevelopment;
- **Health and safety**: site security, avoidance of natural hazards, first aid readiness;

- **Worker well-being**: plazas, child-care on premises, indoor environmental quality, barrier-free design;
- **Corporate citizenship**: regulatory compliance, sustainability disclosure and reporting, independent boards, adoption of voluntary codes of ethical conduct, stakeholder engagement;
- **Social equity and community development**: fair labor practices, affordable/ social housing, community hiring and training; and
- **Local citizenship**: quality design, minimum neighborhood impacts, considerate construction, community outreach, historic preservation.

The overall conclusion of the UNEP FI RPI report was that managers in different areas of the property investment sector could apply RPI:

- Lenders can incorporate RPI criteria into their underwriting processes.
- Asset owners can assess the social and environmental performance of their portfolios and ask fund managers to incorporate RPI principles into their management strategies.
- Fund managers can increase allocations to property types that yield greater social or environmental benefits such as green buildings, brownfield developments, transit-oriented developments, low-income housing, and historic properties.
- Asset and property managers can implement RPI by improving the eco-efficiency of their properties, using fair employment practices, hiring from locally underemployed groups, and engaging in other community programs.
- And developers can create projects that adopt socially and environmentally considerate construction practices, create greener properties, target underserved areas and communities, and incorporate stakeholder consultation through the development process."

In late 2009, Jean Rogers, Lisa Michelle Galley and David Wood published a paper, "Metrics for Responsible Property Investing: Developing and Maintaining a High Performance Portfolio". This study is unique because it proposes specific responsible property investing metrics and includes the feedback of investors who road-tested the proposed metrics within their acquisition and portfolio management activities. This study can be downloaded at http://www.galleyecocapital.com/tag/principles-of-responsible-investing/ .

Investment Returns from Responsible Property Investment: Energy Efficient, Transit-oriented and Urban Regeneration Office Properties in the US from 1998-2009, Gary Pivo and Jeffrey D. Fisher, Oct. 11, 2008, rev. Mar. 3, 2009 and Feb. 2010.

This work shows that investors could have purchased a portfolio consisting solely of RPI office properties over the past 10 years and had performance that was better, at less risk, than a portfolio of properties without RPI features. With few exceptions, RPI properties

had incomes, values per square foot, price appreciation and total returns that were either higher or insignificantly different from conventional properties with lower or insignificantly different cap rates.

Based on this evidence, the authors conclude that investors can be socially responsible while also earning competitive rates of return. Moreover, since RPI can produce social and environmental benefits while fulfilling fiduciary obligations, it would be economically irrational in social welfare terms and ethically unjustifiable for investors to not engage in Responsible Property Investing.

Government Regulations and Incentives

With thousands of municipal, state, provincial, and federal governments working to develop and refine their sustainable building policies, building codes and regulations, change will be the operative word for assessment of the financial implications of government regulations and incentives. With the recognition growing that real estate related actions are some of the lowest hanging fruit to reduce global warming, regulations and incentives should be expected to increase. In fact, in many locales, there has been a move from incentives to mandates. These trends are likely to continue.[25]

LEED USA Changes[26]

It should be understood that LEED and other building certifications and performance measurement systems are designed to allow change and improvement over time. For example, LEED 2009, the result of the latest round of changes to LEED in the USA, incorporates a number of significant changes including:

- Reweighting of some points to better reflect the environmental/energy benefits achieved;
- Incorporation of regional innovation credits;
- Reorganization of weighting to better address property type differences; and,
- Creation of LEED bookshelf—better, more logical alignment and harmonization. (link)

The LEED structure will be familiar to those versed in the current LEED Rating Systems. Most of the structural and technical changes incorporated into LEED 2009 were designed to create a LEED Rating System that can be part of a continuous improvement cycle. LEED 2009 is not a "tear down and rebuild" of the LEED that exists in the market but

[25] A global study of greenhouse gas abatement measures identified real estate related actions such as building insulation, water heating, and lighting systems as the least cost—in fact negative/minimal cost—to implement. "A Cost Curve for Greenhouse Gas Reduction," Enkvist, Naucler, and Rosander, *McKinsey Quarterly*, June 2007.

[26] Information on changes obtained from USGBC web site and interviews with USGBC staff in Summer 2008. (http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1849).

rather a reorganization of the existing LEED Rating Systems along with several key advancements.

USGBC's evolution of the LEED Green Building Rating System is a multi-faceted initiative to streamline and create capacity for LEED project execution, documentation and certification. This initiative is referred to as LEED Version 3 (commonly referred to as LEED v3). In the spirit of the most successful LEED projects, this initiative has been undertaken in an integrated fashion made up of 3 key pieces:

- LEED 2009 – LEED Rating System updates/revisions
- Revision and evolution of the LEED certification process
- LEED Online v3

As a part of the broader vision for LEED v3, the certification bodies for the LEED Green Building Rating System were announced in July 2008. They are:

- ABS Quality Evaluations, Inc. (http://www.abs-qe.com/)
- BSI Management Systems America, Inc. (http://www.bsi-global.com/)
- Bureau Veritas North America, Inc. (http://www.us.bureauveritas.com/)
- DNV Certification (http://www.dnvcert.com/)
- Intertek (/http://www.intertek-sc.com/)
- KEMA-Registered Quality, Inc. (http://www.kema.com)
- Lloyd's Register Quality Assurance Inc. (http://www.lrqausa.com/)
- NSF-International Strategic Registrations (http://www.nsf.org)
- SRI Quality System Registrar, Inc. (http://www.sri-i.com)
- Underwriters Laboratories-DQS Inc. (http://www.ul.com/mss)

Other key changes have included the further development and rollout of USGBC's Portfolio Program for Existing Buildings. This new program is intended to facilitate the permanent integration of green building and operational measures into a company's standard business practices. USGBC is working with pilot participants to develop volume certification submittal documentation, quality control and education plans, policy language, and other resources that will help integrate the adoption of LEED into the design, construction and operations practices of participating organizations. Green cleaning specifications and contracts, continuous commissioning, preventive maintenance tracking systems, and measurement and verification systems are key parts of the program, although the program does provide flexibility to accommodate individual property and/or portfolio circumstances. More information can be found at http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1729#program_goals.

As part of LEED v3, the latest version of the Green Building Council's program for green building design, construction, operations and maintenance, buildings seeking LEED certification will begin submitting operational performance data on a recurring basis as a precondition to certification.

Projects can comply with the performance requirement in one of three ways:

1. The building is recertified on a two-year cycle using LEED for Existing Buildings: Operations and Maintenance.
2. The building provides energy and water usage data on an ongoing basis annually.
3. The building owner signs a release that authorizes USGBC to access the building's energy and water usage data directly from the building's utility provider.[27]

Improved data and performance measurement is important to proper financial analysis and valuation. Despite some concerns, groups like ASHRAE and BOMA are generally supportive, but important legal and related issues need to be worked out, such as: risks/costs of potential decertification, requirements that continue after sale of building, third-party rights to initiate decertification, landlord policing of tenants/land owners, ability of meters/buildings to supply needed data, responsibility of costs for new meters, etc. [28]

ASHRAE 189P Standards

Standard 189P (Standard for the Design of High Performance Green Buildings, Except Low-Rise Residential Buildings) is the first proposed US standard to target inclusion in building codes. The standard will address such issues as renewable power generation, lighting and water efficiency, sustainable site selection, and indoor air quality. This standard will have broad applicability to all building types and be better suited to building codes than LEED or other certification systems that were not designed for use in building codes. This code has been under development for at least three years with significant input by many individuals and groups and is available for purchase from the ASHRAE website.

E. How Sustainable Property Certifications Affect Value

Traditional real estate financial analysis and valuation, given its property-specific and qualitative nature, is well suited to address the complexity of multiple certification and assessment methods. As will be discussed in detail in Chapter V of this book, underwriters and appraisers must simultaneously consider many qualitative and quantitative factors when determining the appropriate rents, occupancies, absorption rates and other key variables in their financial analyses. In this regard, the level of certification, types of sustainable features, and the market's response to these features and certifications, can be addressed as part of an analyst or appraiser's traditional process for evaluating data and supporting key assumptions.

[27] USBVC Press Release, June 25, 2009.

[28] "New LEED Reporting Requirement Causes Concerns," *Architectural Record*, July 29, 2009.

1. Key Findings Influencing Financial Analysis

- Financial analysis and valuation for any single given property is influenced by many sustainability definitions as shown in Exhibit III-6. Valuation and financial analysis are market driven, and the specific sustainability certifications and definitions that influence regulators, space users, and investors will drive the financial analysis and valuation.

Exhibit III-6
No Single Definition Sufficient for Financial Analysis

Benefit Analysis	Potential Benefits	Key Certifications/Definitions
Government Regulation and Incentives	• Reduced risk of functional obsolescence • Faster project completion • Incentives • Lower cost of compliance	Sustainable threshold required by: • Federal, state, and local governments • ASHRAE 189P requirements • Utilities
Space User Demand	• Increased revenues • Faster absorption • Better tenant retention • etc.	• Leased Space Leadership Consortium Guidelines • Global Reporting Initiative • Carbon Disclosure Project • IPD Environmental Code • Corporate Social Responsibility Reports
Investor Demand	• Higher sales price • Reduced exit/take-out risk • Reduced marketing time • Improved liquidity	• All certifications important to tenants are important to investors • LEED and EnergyStar gaining stature • Responsible Property Investment Classification • Public pension fund guidelines
Liability Costs	• Reduced property insurance costs	• LEED • Green Globes • GreenGuard (mold)
Operating Costs	• Reduced energy costs	• EnergyStar • Post occupancy performance assessments

- Sustainability is not a property type, but a property performance outcome determined by sustainable features, strategies, and certifications. Accordingly, sustainability is just one of many factors to consider in valuation or underwriting, with the majority of risk and value considerations being driven by traditional factors influencing a building's attractiveness to tenants and investors.
- Environmental certifications and assessments cannot be the primary basis for financial analysis or valuation because:
  - Environmental certifications measure environmental performance, not financial performance;
  - Environmental certification levels are not comparable, because they can be based on entirely different combinations of sustainable features and outcomes;
  - Many properties with valuable sustainable features may not be certified.

- The influence of sustainability on value can be analyzed. For example, every office building has a unique combination of features and attributes, but somehow the industry is able to analyze and value office buildings. Sustainable attributes are just additional unique attributes, which must be considered simultaneously with all a property's attributes.
- LEED certification has become the definitive market leader in the U.S. and a growing influence internationally for the institutional investment market, and, to a significant degree, the owner-occupant market. While certifications like LEED and other leading certification systems around the world cannot be the sole basis for analysis, they have significant value independent of the attributes or performance of the certified property.
- Sustainable certificates with the strongest market acceptance by regulators, users, and investors will have the highest values independent of the sustainable features or building performance. This "premium" for a specific certification will vary significantly over time by property type, market, and level of certification.

2. Key Steps to Evaluate Environmental Sustainability Certifications

This section provides a brief outline of key questions to ask when involved in evaluating the effect of sustainable certifications/requirements on value.

1. What are the key sustainability features and attributes of the property?

2. What are the key attributes/certifications required by **regulators**?
   - Building certifications?
   - Products and materials?
   - Performance, outcomes?
   - Processes, operations?
   - Today versus the future (risk analysis)?

3. What are the key building features and attributes or certifications required by **space users** in your building?
   - Global Reporting Initiative?
   - Carbon disclosure requirements?
   - Health and safety concerns?
   - LEED certification?
   - Energy costs?
4. What is the relative weighting of sustainability considerations versus other key factors driving user demand?
   - Today versus future (risk assessment)?

5. What are the key sustainability features and/or certifications required by **investors**?
    - LEED?
    - All those features required by tenants?
    - Expense reduction?
    - Today versus future (risk assessment)?

6. What are the underlying requirements of regulators, users, and investors regarding critical expense reduction assumptions?
    - Energy?
    - Water?
    - Capital expenditures (durability/obsolescence assumptions)
    - Management expenses?
    - Depreciation & Reserves
    - Other?

7. How reliable and accurate are "modeled" results and what are the implications of uncertainty on future certifications/requirements?

8. What are the relative expenses of, and risks related to, certification?

9. How applicable is general research supporting higher sales prices, rents, productivity and health benefits, expense savings, etc.?
    - Assess applicability of studies to your property based on comparison of sustainable definitions in studies versus the subject property.

3. Key Observations about Property Sustainability Definitions Affecting Financial Analysis

- Growth in the number of sustainability certifications and performance assessment methodologies worldwide will continue for years, but contrary to some predictions, does not have to seriously slow adoption of sustainable building practices. Financial analysis methodologies outlined in "*Value Beyond Cost Savings: How to Underwrite Sustainable Properties*" are well suited to deal with multiple certifications—even on the same property.
- Minimum requirements for sustainable properties are trending higher. Enhanced minimum energy requirements for LEED, the EU Energy Performance in Buildings Directive, and the growing number of local sustainability mandates (versus incentives) are examples of this trend. Rating systems like the European "Green Rating" and labeling programs continue to emerge as alternatives.
- As the sustainable property industry matures, there has been a growing recognition and movement towards adapting certification and assessment systems

to measure actual performance and occupant/building outcomes versus modeled or designed performance. This trend will continue.

- While the corporate real estate and institutional real estate investment communities have dramatically increased their interest in sustainable properties, there is still a gap between their phased and measured approach, and relatively modest goals, and the goals and actions of leading energy and sustainability advocates who are shooting for net zero energy and/or restorative buildings. While this is expected, it is important to understand that different people and groups still have different perspectives on what sustainability means.

F. Key Research Comparing Sustainable Rating Systems

This section identifies and describes some of the key research and resources for evaluating the comparative differences between building certification and assessment systems. The best place to obtain more detailed information on specific certification or rating systems is to follow the links for each of the approximately 100 certification assessment systems that are identified in Appendix III-C, or check code number 4.0 of the Research Library or Industry Resources sections of the Consortium's website.

1. Summary of Key Studies

Some of the key studies that provide comparative assessment of rating systems are presented below.

1. **International Comparison of Sustainability Rating Tools,** Richard Reed, Anita Bilos, Sara Wilkinson, and Karl-Werner Schulte, Journal of Sustainable Real Estate, Fall 2009

   This study presents a comparative analysis of international sustainability tools. It focuses on whether tools from different countries can be directly compared to each other and presents a number of lists of sustainable rating systems used around the world.

   The study focused its comparative analysis on BREEAM, LEED, Green Star, and CASBEE. Its key findings are that the certifications cannot be accurately or usefully compared to each other. One particular issue is that baseline standards from which the certification systems reference are not the same, making performance comparisons difficult. Recommendations to improve transparency are provided.

2. **Sustainable Building Rating Systems Summary**, Pacific Northwest National Laboratory, completed for the General Services Administration, K. M. Fowler, E. N. Roush, July 2006.
   http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=158

This summary document was prepared to offer information on sustainable building rating systems for the General Services Administration (GSA) as part of their evaluation of whether to recognize other credible sustainable building rating systems in addition to LEED (Leadership in Energy and Environmental Design), which the GSA has used since 2003. The document does not provide a specific recommendation for GSA, but rather a summary of information found for each sustainable building rating system.

The information compiled in the document was collected from January 15 to May 1, 2006. This 46-page summary provides the most comprehensive listing of various sustainable building certification and assessment systems we have seen to date. The report filters the literally hundreds of system that they review through a variety of screens, providing identification and short descriptions of many different rating systems.

Based on the specific requirements of the GSA, and their screening approach, they selected five systems to compare in detail:

- BREEAM;
- CASBEE;
- GBTool;
- Green Globes™ US;
- LEED®.

Scores of sustainable design and operations related systems were pre-screened from the analysis because they focused only on energy; were primarily modeling software; focused narrowly on products; provided guidelines, not a certification system; were property type specific; were only life cycle assessment tools; and other reasons. However, the listing of the systems they eliminated is quite useful.

3. **Green Building Rating Systems**, a comparison of the LEED® and Green Globes™ systems in the U.S., prepared for the Western Council of Industrial Workers, Timothy Smith, Mirian Fischlein, Sangwan Suh, Pat Huelman, University of Minnesota, September 2006.
http://www.thegbi.org/assets/pdfs/Green_Building_Rating_UofM.pdf

This document's strength is that it provides a direct comparison on a point-by-point basis between two important sustainable building rating systems and presents a methodology for evaluating and conducting such comparison. The report provides comparative matrices, and attempts to address the content and weighting priority specific to each rating system, as well as the processes related to how the systems may be implemented in practice.

4. **Quantifying Sustainability: A Study of Three Sustainable Building Rating Systems and the AIA Position Statement**, AIA Sustainability Discussion Group, May 2008. http://www.aia.org/release_050808_greenrating

   The purpose of this report is to provide information on how three unique, creative and evolving green building rating systems resonate in various dimensions with the goals of the AIA position statement on sustainability. It is important to note that while the study offers a side by side comparison of the rating systems to the position statement, and thereby offers a guide to choosing a rating system based on AIA's criteria, it does not intend to rank or grade the systems against each other. The three systems that they evaluate are Green Globes™ for new construction, LEED® for new construction and major renovation version 2.2 (LEED NC), and SBTool 07. The three systems were chosen based on their level of acceptance in the American market, their differences and objectives, and a desire to provide some indication of the range of systems available.

5. **UNEP-FI/SBCI's Financial and Sustainability Metrics, The United Nations Environmental Programme, Finance Initiative and Sustainable Buildings and Construction Initiative, Clare Lowe and Alfonso Ponce, 2008**

   This report outlines common performance indicators for sustainable building, discusses in detail key financial indicators for sustainable buildings, and does a comparative assessment of six key certification systems and describes many more. http://www.unepfi.org/publications/property/index.html

6. **Definition of Sustainable Commercial Buildings**, Patrick Burk, September 27, 2007, YourBuilding.org website http://www.yourbuilding.org/display/yb/Definition+of+sustainable+commercial+buildings

   YourBuilding's section on the definition of sustainable commercial buildings provides some basic description of the features of certified buildings as well as a summary of sustainability rating tools, with a focus on Australia, but also linked to some of the key international systems.

7. **Green Building Standards Around the World**, Charles Lockwood, *Urban Land*, June 2007.

   This column does a pretty good job of summarizing the status of select key sustainable property standards and rating systems throughout the world as of June 2007. It provides a good point in time assessment to compare to conditions as they evolve over time.

8. **Sustainability in Property Valuation—Theory and Practice**, David Lorenz & Thomas Lützkendorf, 2008 draft paper.

This paper provides practical background information to better understand the issues involved in property valuation.

On page 23 of their draft paper they discuss some of the prior comparative certification system work that has been completed and identify additional places where information on assessment tools can be found, including the former research project (IEA Annex 31, 2001), and the continuous review of the European Thematic Network on Practical Recommendations for Sustainable Construction (PRESCO). They also conclude, on a preliminary basis, that the only assessment approach suitable as a basis for worldwide application is SBTool. SBTool has emerged from the former GBTool, which was developed under the leadership of the International Initiative for Sustainable Built Environment. SBTool makes possible a comparison of assessment results across regions through the use of a common set of assessment criteria and national/regional benchmarks and weighting factors. They also caveat that SBTool and other systems need additional refinement to provide the consistent assessment best for valuation.

9. **Addressing Risk and Uncertainty in Property Valuations: A Viewpoint from Germany**, David Lorenz, Stefan Trück, Thomas Lützkendorf, Journal of Property Investment and Finance, Volume 24, Number 5, 2006.

   The authors in this report discuss some of the challenges in valuing sustainable properties. They also address some of the issues in identifying and expressing risk through a sustainable building rating system. They provide a summary of some important European rating systems and a discussion of their applicability from a German perspective.

10. **Discussion Document: Comparison of International Environmental Assessment Methods for Buildings**, BREEAM website.

    This document provides a discussion of the portability to other countries of the three most highly regarded assessment methods--LEED, CASBEE, and Green Star—compared to the local UK benchmark of BREEAM. http://www.breeam.org/page.jsp?id=101

11. **ASTM Committee E06 on Performance of Buildings, Subcommittee E06.71 on Sustainability.** http://www.astm.org/COMMIT/COMMITTEE/E06.htm

    The ASTM Committee E06 on performance of buildings was formed in 1946. The Technical Subcommittee on Sustainability E06.71, like their other subcommittees, maintains jurisdiction over a wide range of standards, as presented below.

    Active sustainable building standards under the jurisdiction of ASTM:

E1971-05 Standard Guide for Stewardship for the Cleaning of Commercial and Institutional Buildings

E1991-05 Standard Guide for Environmental Life Cycle Assessment (LCA) of Building Materials/Products

E2114-06a Standard Terminology for Sustainability Relative to the Performance of Buildings
See also WK1240 proposed revision

E2129-05 Standard Practice for Data Collection for Sustainability Assessment of Building Products
See also WK20545 proposed revision
See also WK20546 proposed revision

E2392-05 Standard Guide for Design of Earthen Wall Building Systems
See also WK16155 proposed revision

E2396-05 Standard Test Method for Saturated Water Permeability of Granular Drainage Media [Falling-Head Method] for Green Roof Systems

E2397-05 Standard Practice for Determination of Dead Loads and Live Loads associated with Green Roof Systems

E2398-05 Standard Test Method for Water Capture and Media Retention of Geocomposite Drain Layers for Green Roof Systems

E2399-05 Standard Test Method for Maximum Media Density for Dead Load Analysis of Green Roof Systems

E2400-06 Standard Guide for Selection, Installation, and Maintenance of Plants for Green Roof Systems

E2432-05 Standard Guide for General Principles of Sustainability Relative to Buildings

Proposed new sustainable building standards under the jurisdiction of ASTM

WK3161 Marketing and Product Claims Related to Sustainable Building

WK7319 Standard Guide for Use of Expanded Shale, Clay or Slate (ESCS) as a Mineral Component in Growing Media for Green Roof Systems

WK11944 Minimum Attributes of a Building that Promotes Sustainability

WK18426 Water Conservation In Buildings Through In Situ Water Reclamation

12. The International Organization for Standardization, Sustainability Standards.

The International Organization for Standardization is the world's largest developer and publisher of international standards. ISO is a network of the international standards institutes from 157 countries, one member per country, with the central secretary in Geneva, Switzerland, that coordinates the system.

ISO is a non-governmental organization that forms a bridge between the public and private sectors. ISO enables a consensus to be reached on solutions that meet multiple requirements based on the broader needs of society.

The ISO has developed a number of key sustainability standards including:

ISO 15392:2008, Sustainability in building construction—General principles.
http://www.astm.org/COMMIT/COMMITTEE/E06.htm
ISO 15392:2008 identifies and establishes general principles for sustainability in building construction. It is based on the concept of sustainable development as it applies to the life cycle of buildings and other construction works, from their inception to the end of life.

ISO 21930:2007, Sustainability in building construction—Environmental declaration of building products.
http://www.astm.org/COMMIT/COMMITTEE/E06.htm

ISO 21930:2007 provides a framework for and the basic requirements for product category rules as defined in ISO 14025 for type III environmental declarations of building products.
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=40435
Type III environmental declarations for building products, as described in ISO 21930:2007, are primarily intended for use in business-to-business communication, but their use in business-to-consumer communication under certain conditions is not precluded.

ISO/TX 21929-1:2006, Sustainability in building construction – Sustainability indicators – Part 1: Framework for development of indicators for buildings.
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=40436

ISO/TS 21929-1:2006 provides a framework, makes recommendations, and gives guidelines for the development and selection of appropriate sustainability indicators for buildings.

ISO/TS 21931-1:2006, Sustainability in building construction—Framework for methods of assessment for environmental performance of construction works—Part I: Buildings.
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=40434
ISO/TS 21931-1:2006 provides a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings. It identifies and describes issues to be taken into account when using methods for the assessment of environmental performance for new or existing building properties in the design, construction, operation, refurbishment and deconstruction stages.

G. Conclusions

Evaluating property sustainability is not an easy task given the thousands (when governmental regulations are included) of different certification and assessment systems. Fortunately for underwriters and valuers, the task can be simplified by focusing only on those certifications or assessments applicable to the regulators, users, and investors of the subject property.

Appendix III-A
Sustainable Property Features List

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This list—a menu of sorts—presents the types of features, actions, processes, etc. that together, in some combination, define a sustainable property. The references are to LEED, Green Globes, and a draft ASHRAE 189P document from the middle of 2007. The list was compiled from a review of sustainable property rating systems, trade associations, publications, books, case studies and websites, including the following:

- LEED (New Construction[29], Existing Buildings, Core & Shell, Commercial Interiors)
- Green Globes
- ASHRAE 189P[30]
- NAHB
- BOMA International, 30 Easy Ways to Save Energy For Little or No Cost
- Sustainable Building Technical Manual[31]

As discussed in Chapter III: "Evaluating Property Sustainability," LEED and 189P have changed significantly since this appendix was prepared.

The list is organized primarily by the six LEED categories with the addition of Operations & Maintenance and Miscellaneous categories, as follows:

1. Sustainable Sites
2. Water Efficiency
3. Energy & Atmosphere
4. Materials & Resources
5. Indoor Environmental Quality
6. Innovation & Design Process
7. Operations & Maintenance
8. Miscellaneous

It should be noted that many of the LEED prerequisites and credits are outcome oriented, for example, Optimize Energy Efficiency. Achieving the outcome can be accomplished through a combination of features, such as daylighting, occupancy sensors, re-lamping, etc. In such instances, we have attempted to list these individual sub-features adjacent to the more general LEED feature.

[29] LEED-NC (New Construction) addresses design and construction features for both new buildings and major renovations of existing buildings.

[30] ASHRAE 189P: Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings (Public Review Draft May 2007). It should be noted that ASHRAE 189P is a standard for high-performance buildings and not a sustainability rating system.

[31] Public Technology, Inc, USGBC

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Sustainable Sites						
SS	Construction Activity Pollution Prevention	Construction Activity Pollution Prevention	Create and implement a plan to prevent the loss of soil during construction by stormwater run-off and/or wind erosion, including protecting topsoil by stock piling for reuse, prevent sedimentation of storm sewer or receiving streams, and prevent polluting the air with dust and particulate matter. No idling of construction vehicles during project construction. Sedimentation is the addition of soils to water bodies by natural and human-related activities.	NC-SS.p1 CS-SS.p1	B.2	10.3.7 10.3.9.1
SS	Site Selection	Site Selection	Avoid developing buildings, hardscape, roads or parking areas on portions of sites that meet any one of various criteria: farmland, previously undeveloped land and low elevations, within 50 feet of a water body, land that is specifically identified as a habitat for endangered species, within 100 feet of wetlands or land which was formerly public parkland.	NC-SS.c1 CS-SS.c1 CI-SS.c1	B.1	5.3.1.2
SS	Development Density & Community Connectivity	Development Density & Community Connectivity	Can be achieved by 1) constructing or renovating a building on a previously developed site and in a community with a minimum density or by 2) constructing or renovating a building on a previously developed site and within 1/2 mile of a residential zone or neighborhood with a given density, and within 1/2 mile of at least 10 Basic Services (See LEED NCp.33) and with pedestrian access between the building and the services.	NC-SS.c2 CS-SS.c2 CI-SS.c2	B.1	5.3.1.1
SS	Brownfield Redevelopment	Brownfield Redevelopment	Develop on a site documented as contaminated or on a site defined as a Brownfield by a local, state or federal government agency.	NC-SS.c3 CS-SS.c3 CI-SS.c1	B.1	5.3.1.1
SS	Alternative Transportation	Public Transportation Access	Locate the project within 1/2 mile of an existing - or planned and funded - commuter rail, light rail or subway station, or locate the project within 1/4 mile of one or more stops for two or more public or campus bus lines useable by building occupants.	NC-SS.c4.1 EB-SS.c3.1 CS-SS.c4.1 CI-SS.c3.1	B.1, C.5	10.3.6

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
SS	Alternative Transportation	Bicycle Storage	Can be achieved in commercial or institutional buildings by providing secure bicycle racks and/or storage for 5% or more of all building users. For residential buildings, provide covered storage facilities for securing bicycles for 15% or more of building occupants.	NC-SS.c4.2 EB-SS.c3.2 CS-SS.c4.2 CI-SS.c3.2	C.5	10.3.6
SS	Alternative Transportation	Changing Rooms	Can be achieved for commercial or institutional buildings by providing shower and changing facilities in the building or nearby for 0.5% of Full-Time Equivalent occupants.	NC-SS.c4.2 EB-SS.c3.2 CS-SS.c4.2 CI-SS.c3.2	C.5	10.3.6
SS	Alternative Transportation	Low-Emission & Fuel Efficient Vehicles	Provide low-emitting and fuel-efficient vehicles for 3% of Full-Time Equivalent (FTE) occupants and provide preferred parking for these vehicles. Provide preferred parking for low-emitting and fuel-efficient vehicles for 5% of the total vehicle parking capacity of the site. Install alternative-fuel refueling stations for 3% of the total vehicle parking capacity of the site. "Preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.	NC-SS.c4.3 EB-SS.c3.3 CS-SS.c4.3		10.3.6
SS	Alternative Transportation	Parking Capacity	Size parking capacity to not exceed the minimum local zoning requirements and provide preferred parking for car pools or vanpools. Also by providing infrastructure and support programs to facilitate shared vehicle usage such as car pool drop-off areas, designated parking for van pools or car-share services, ride boards, and shuttle services to mass transit. And finally by providing no new parking at all.	NC-SS.c4.4 EB-SS.c3.4 CS-SS.c4.4 CI-SS.c3.3	C.5	10.3.6
SS	Site Development	Protect or Restore Habitat	Can be achieved on Greenfield sites (those that are not previously developed or graded and remain in a natural state) by limiting all site disturbances around the building perimeter, surface walkways, patios, surface parking and utilities, roadway curbs and main utility branch trenches, and constructed areas with permeable surfaces. On previously developed or graded sites by restoring or protecting a minimum of 50% of the site area (excluding the building footprint) with native or adapted vegetation.	NC-SS.c5.1 EB-SS.c4 CS-SS.c5.1	B.2	5.3.2.2

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
SS	Site Development	Maximize Open Space	Options include reducing the development footprint and/or providing vegetated open space within the project boundary to exceed the local zoning's open space requirement for the site by 25%. For areas with no local zoning requirements, by providing vegetated open space area adjacent to the building that is equal to the building footprint. Where a zoning ordinance exists, but there is no requirement for open space, by providing vegetated open space equal to 20% of the project site area. (Specific measures specified above are LEED-NC requirements)	NC-SS.c5.2 CS-SS.c5.2		5.3.2.1 5.3.2.2
SS	Stormwater Design	Quantity Control	Stormwater control of the amount of runoff into sewer systems or receiving waters. Specific property features include vegetated roofs, pervious paving, and reuse of stormwater for non-potable uses, such as landscape irrigation, toilet and urinal flushing and custodial uses (see below for detail). Can be achieved by implementing a stormwater management plan that prevents the post development peak discharge rate and quantity from exceeding the predevelopment peak discharge rate and quantity for the one- and two-year, 24-hour design storms. Or by implementing a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies. Or by implementing a stormwater management plan that results in a 25% decrease in the volume of stormwater run-off from the two-year, 24-hour design storm. Stormwater runoff consists of water volumes that are created during precipitation events and flow over surfaces into sewer systems or receiving waters. All precipitation waters that leave project site boundaries on the surface are considered to be stormwater runoff volumes.	NC-SS.c6.1 EB-SS.c5 CS-SS.c6.1 CI-SS.c1	B.3	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
SS	Stormwater Design	Quality Control	Stormwater control that reduces pollutant loadings. Specific property features include vegetated roofs, pervious pavement or grid pavers, rain gardens, vegetated swales, disconnection of imperviousness, and rainwater recycling (see below for detail).	NC-SS.c6.2 EB-SS.c5 CS-SS.c6.2 CI-SS.c1		
SS	Stormwater Design	Green or Vegetated Roofs	Roofs covered with a soil layer and plantings.		B.3	5.3.2.1
SS	Stormwater Design	Pervious or Permeable Paving	Permeable paving systems that allow water to infiltrate directly into the ground. Applications include porous asphalt, porous concrete, porous turf, and open-jointed blocks.			5.3.2.1
SS	Stormwater Design	Stormwater Reuse/Rainwater Recycling	The use of retention ponds or cisterns to capture rainwater, which after being treated if necessary, can be used on-site for non-potable uses.			
SS	Stormwater Design	Rain Gardens				
SS	Stormwater Design	Vegetated Swales or Bioswales	Planted ditches that allow stormwater to infiltrate into the ground.			
SS	Stormwater Design	Disconnection of Imperviousness	Separation of impervious surfaces to allow for water infiltration.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
SS	Heat Island Effect	Non-Roof	A combination of several strategies/features for a portion of (at least 50% for LEED-NC) the site hardscape (including roads, sidewalks, courtyards and parking lots; and may also apply to above-grade building walls, retaining walls and the top horizontal surface of ground level AC condenser units), tree and architectural shade, paving materials with a minimum Solar Reflectance Index (SRI) such as gray or white paving, and open grid pavement system. Or alternatively, by placing a minimum 50% (for LEED-NC) of parking spaces under cover (defined as underground, under deck, under roof, or under a building). Heat island effects occur when warmer temperatures are experienced in urban landscapes compared to adjacent rural areas as a result of solar energy retention on constructed surfaces. The principal surfaces that contribute to the heat island effect include streets, sidewalks, parking lots and buildings.	NC-SS.c7.1 EB-SS.c6.1 CS-SS.c7.1 CI-SS.c1	B.2	5.3.3.1 5.3.3.2
SS	Heat Island Effect	Roof	Options include using roofing materials (such as white or white metal) having a minimum Solar Reflectance Index for a minimum of 75% (for LEED-NC) of the roof surface. Or installing a vegetated roof for at least 50% (for LEED-NC) of the roof area. Or installing high albedo and vegetated roof surfaces that, in combination, meet certain criteria. CR, CR The term albedo is synonymous with solar reflectance. Solar reflectance is the ratio of the reflected solar energy to the incoming solar energy over wavelengths in a given range. A reflectance of 100% means that all of the energy striking a reflecting surface is reflected back into the atmosphere and none of the energy is absorbed by the surface.	NC-SS.c7.2 EB-SS.c6.2 CS-SS.c7.2 CI-SS.c1	B.2	5.3.3.3

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
SS	Light Pollution Reduction	Light Pollution Reduction	The features include the location, intensity and control of various lighting fixtures in the buildings. The angle of maximum candela (the direction in which the luminaire or fixture emits the greatest luminous intensity) from each interior luminaire as located in the building shall intercept opaque building interior surfaces and not exit out through the windows. Or all non-emergency interior lighting shall be automatically controlled to turn off during non-business hours. Provide manual override capability for after hours use. And for exterior lighting, only light areas as required for safety and comfort. Light pollution is waste light from building sites that produces glare, is directed upward to the sky or is directed off the site.	NC-SS.c8 EB-SS.c7 CS-SS.c8 CI-SS.c1	B.2	5.3.4.1 5.3.4.2
SS	Tenant Design and Construction Guidelines	Tenant Design and Construction Guidelines	Provide a copy of the Tenant Design and Construction Guidelines to tenants, including a description of the sustainable design and construction features incorporated into the Core & Shell project, information enabling the tenant to integrate their space design and construction with the core and shell systems, and information on LEED-CI and how the core and shell building contributes to achieving those credits.	CS-SS.c9		
SS		Emergency Response Plan	Environmental emergency procedures are in place to address emergencies such as spills, fires, explosions, excessive wind or other incidents with regard to emergency response during site preparation or construction.		A.4	
SS		Sustainable Sites - Measurement and Verification Plan	Where trees and vegetation have been used to comply with shade requirements, verify that this shade is obtained within five years after trees and vegetation are planted at the project site.			10.3.3.1
SS		Bird Collision Avoidance	Design strategies to avoid bird collisions with windows or other parts of the structure.		B.4	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Water Efficiency						
WE	Water Efficient Landscaping	Reduce Potable Water Use for Irrigation	Reductions can be achieved by a combination of features/elements including plant species factor (e.g., drought tolerant plants, native plants, adapted plants, avoidance of lawn), irrigation efficiency, hydrozoning, smart controller with evapotranspiration, use of captured rainwater, use of recycled rainwater, and use of water treated and conveyed by a public agency specifically for non-potable uses. The LEED-NC requirement is to reduce potable water consumption for irrigation by 50% from a calculated mid-summer baseline case. Potable water is suitable for drinking and supplied from wells or from municipal water systems. Xeriscaping (TM) is water-conserving landscaping with regionally appropriate plants and planting techniques (such as mulching) that reduce or eliminate water use other than from normal precipitation in the area. Evapotranspiration (ET) is the sum of evaporation and plant transpiration. Evaporation accounts for the movement of water to the air from sources such as the soil, canopy interception, and water bodies. Transpiration accounts for the movement of water within a plant and the subsequent loss of water as vapor through stomata in its leaves.	NC-WE.c1.1 EB-WE.c1 CS-WE.c1.1 CI-SS.c1	B.4, D.2	6.3.1.1-3
WE	Water Efficient Landscaping	No Potable Use or No Irrigation	Irrigation is conducted using only captured rainwater, recycled wastewater, recycled graywater, or water treated and conveyed by a public agency specifically for non-potable uses. Or by installing landscaping that does not require permanent irrigation systems. Graywater is defined as "untreated household wastewater which has not come into contact with toilet waste. Graywater includes used water from bathtubs, showers, bathroom washbasin and water from clothes washer and laundry tubs. It shall not include wastewater from kitchen sinks or dishwashers." (As defined by the Uniform Plumbing Code).	NC-WE.c1.2 EB-WE.c1 CS-WE.c1.2 CI-SS.c1	D.2, D.3	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
WE	Innovative Wastewater Technologies	Innovative Wastewater Technologies - General	Reduce potable water use for building sewage conveyance by 50% (for LEED-NC) through the use of water-conserving fixtures (water closets, urinals, faucets, shower heads) or non-potable water (captured rainwater, recycled graywater and onsite or municipally treated wastewater). Or by treating 50% (for LEED-NC) of wastewater onsite to tertiary standards. Features to be employed include high efficiency fixtures and dry fixtures such as composting toilet systems and non-water using urinals, the reuse of stormwater or graywater for sewage conveyance or onsite wastewater treatment systems, avoid or eliminate the use of potable water to spray roofs. Options for onsite wastewater treatment include packaged biological nutrient removal systems, constructed wetlands, and high-efficiency filtration systems. CR, CR Tertiary treatment is the highest form of wastewater treatment that includes the removal of nutrients, organic and solid material, along with biological or chemical polishing.	NC-WE.c2 EB-WE.p1 EB-WE.c2 CS-WE.c2 CI-SS.c1 CI-WE.c1.1 & 1.2	D.3	6.3.2.1 6.3.2.4
WE	Innovative Wastewater Technologies	Automatic Fixture Sensors	Motion sensors that automatically turn on or off lavatories, sinks, water closets and urinals. Sensors may be hard-wired or battery operated.			
WE	Innovative Wastewater Technologies	Metering Controls	Generally, manual on/automatic off controls which are used to limit the flow time of water. Most commonly installed on lavatory faucets and showers.			
WE	Innovative Wastewater Technologies	Non-Water-Using Urinal	A urinal that uses no water, but instead replaces the water flush with a specifically designed trap that contains a layer of buoyant liquid that floats above the urinal layer, blocking sewer gas and urine odors from the room.			
WE	Innovative Wastewater Technologies	Composting Toilet Systems	Dry plumbing fixtures that contain and treat human waste via microbiological processes.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
WE	Innovative Wastewater Technologies	Water Use Reduction Devices	Low-flow toilets, dual flush toilets, half-gallon flush urinals, low-flow lavatory faucets, faucet aerators and low-flow showerheads. Also horizontal axis washing machines and closed loop cooling of equipment.			
WE	Innovative Wastewater Technologies	Captured Rainwater	The use of retention ponds or cisterns to capture rainwater, which after being treated if necessary, can be used on-site for non-potable uses.			
WE	Innovative Wastewater Technologies	Recycled Graywater	The use of recycling systems to capture graywater, which after being treated if necessary, can be used on-site for non-potable uses.			
WE	Innovative Wastewater Technologies	Onsite Wastewater Treatment	The use of localized treatment systems to transport, store, treat and dispose of wastewater volumes generated on the project's site.			
WE	Innovative Wastewater Technologies	Capture of Cooling Tower Waste	Capture and reuse of cooling tower waste (chemical free only) for irrigation or non-potable uses.		D.2	
WE	Innovative Wastewater Technologies	Condensate Capture	Condensate capture and reuse at cooling tower.			6.3.2.3
WE	Innovative Wastewater Technologies	Water Efficient Appliances	Clothes washers and dishwashers that comply with EPA Energy Star requirements and/or have a certain maximum water factor (gallons/cycle).			6.3.2.2

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
WE	Water Use Reduction	Water Use Reduction	Strategies that, in aggregate, reduce water use (by 20% or 30% for LEED-NC c3.1 & c3.2, respectively) when compared to the baseline for the building. See features under Innovative Wastewater Technologies.	NC-WE.c3.1 & 3.2 EB-WE.c3 CS-WE.c3.1 & 3.2 CI-SS.c1 CI-WE.c1.1 & 1.2	D.1, D.3	
WE	Discharge Water	Avoid Contamination of Discharge Water and Compliance	Use of oil separators, grease interceptors and other filtration (silver recovery units on drains in photo finishing facilities, lint traps in laundry facilities, drain traps where there may be hazardous spills, interceptors/clarifiers in parking lots and garages) for building generated discharges and proper disposal of any wastes collected. If regulated by EPA National Pollution Discharge Elimination System (NPDES) Clean Water Act requirements, demonstrate compliance as required.	EB-WE.p2	F.3	
WE		Water Metering	Integrated controls, instrumentation and metering to allow for measurement and verification of project water use for both potable and reclaimed water, and communication to a data management system with hourly, daily, monthly and annual reporting capabilities for each meter and sub-meter.		D.2	6.3.3.1-3

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Energy & Atmosphere						
EA	Fundamental Commissioning of the Building Energy Systems	Fundamental Commissioning of the Building Energy Systems (also Acceptance Testing)	A verification of the performance of building systems and assemblies. Commissioning (Cx) activities are conducted at a minimum for heating, ventilating, air conditioning, and refrigeration (HVAC & R) systems and associated controls; lighting and daylighting controls; domestic hot water systems; renewable energy systems (such as wind and solar). Commissioning may also include water-using systems, building envelope systems and other systems as appropriate. The Basis of Design includes design information necessary to accomplish the Owner's Project Requirements. The Owners Project Requirements is a written document that details the functional requirements of a project and the expectations of how it will be used and operated.	NC-EA.p1 EB-EA.p1 CS-EA.p1 CI-EA.p1	A.3	10.3.1 10.3.2
EA	Minimum Energy Performance	Minimum Energy Performance	Accomplished by complying with the mandatory provisions of ASHRAE/IESNA 90.1-2004 and also its prescriptive requirements. Since this a minimum standard no sustainable feature descriptions are included here. (See below.) Under the Performance Option of ASHRAE 189P, minimum standards are set on the project's annual energy cost and annual Carbon Dioxide Equivalent.CR CR Carbon Dioxide Equivalent (CO^2e) is a measure used to compare the impact of various greenhouse gases based on their global warming potential (GWP). CO^2e approximates the time-integrated warming effect of a unit mass of a given greenhouse gas, relative to that of carbon dioxide (CO^2e).	NC-EA.p2 EB-EA.p2 CS-EA.p2 CI-EA.p2	C.1, C.3	7.5.2 7.5.3

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA	Fundamental Refrigerant Management	Fundamental Refrigerant Management	Zero use of CFC-based refrigerants in new base building HVAC & R systems. For existing base building HVAC equipment, completing a comprehensive CFC phase-out conversion. Chlorofluorocarbons (CFCs) are hydrocarbons that deplete the stratospheric ozone layer. Hydrochlorofluorocarbons (HCFCs) are refrigerants that cause significantly less depletion of the stratospheric ozone layer compared to CFCs. Refrigerants are the working fluids of refrigeration cycles.	NC-EA.p3 EB-EA.p3 CS-EA.p3 CI-EA.p3	F.2	8.3.3
EA	Optimize Energy Performance	Optimize Energy Performance - General	Reductions in energy use can be accomplished through a variety of combinations of sustainable energy features noted below.	NC-EA.c1 EB-EA.c1 CS-EA.c1 CI-EA.c1.1-1.4	C.1, C.3	
EA	Building Envelope	Interventions	Envelope improvements such as double skin, increased insulation and thermal breaks at windows. A continuous building envelope air barrier membrane joined in an airtight and flexible manner to adjacent assemblies. Best practices for vapor retarder. Quick-closing doors.		C.2	7.4.2
EA	Building Envelope	High Performance Glazing	Glazing uses metallic layers of coating or tints to either absorb or reflect specific wavelengths in the solar spectrum. High performance glazing may include glazing with a minimum visible light transmission to solar heat gain coefficient. It may also include switchable glazing such as photochromic, thermochromic or electrochromic (adjusting translucency according to light, heat or electrical current, respectively) and liquid crystal (LCD), also adjusted via electrical current.		C.2	7.4.2

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA	Building Envelope	Fenestration Distribution	Fenestration equally distributed in horizontal bands across all four orientations. Limits may apply to total vertical fenestration area as a percent of gross wall area (e.g., 40% for ASHRAE 189P), and may vary by climate zone. CR, CR Fenestration is any opening or arrangement of openings in a building (normally filled with glazing) that admits daylight and any devices adjacent to the opening that affect light distribution, such as baffles, louvers, draperies, etc.		C.2	7.4.2 9.3.7 9.4.1.1
EA	Building Envelope	Cool Roofs	Light colored roof finishes that have low heat absorption and reflect the sun's energy before it penetrates the building.		C.2	7.4.2
EA	Building Envelope	Shading Projections	Shadings, which reduce the solar gains on the glazing.		C.2, G.3	7.4.2 9.4.1.2
EA	Building Envelope	Interior Shading Devices	Manual or automated moveable shading devices.		C.2, G.3	9.4.1.2
EA	Lighting Systems	Lighting Power Reduction	Reduce connected lighting power density below ASHRAE/IESNA 90.1 Standard.	CI-EA.c1.1		7.4.6
EA		Day Lighting	The controlled admission of natural light into a space through glazing with the intent of reducing or eliminating electric lighting. Creates a stimulating and productive environment for building occupants. Four types of daylight apertures are windows, skylights, clerestories (vertical windows placed at or near the top of exterior walls), and monitors (stepped roof combined with clerestories).		C.2, G.3	9.3.7
EA		Daylighting Controls	Lighting controls in building areas with daylighting, to continuously dim lights, stepped or multi-level switching and separate on-off switching.		C.2	7.4.6
EA		Ventilation Controls	Automatic operable windows, window treatments or vents to provide fresh air directly from outside in response to room and external temperatures. Interlock between the use of operable windows and automated HVAC controls (e.g. to avoid using a window to cool down space that is being heated).	CI-EQ.c6.2	C.2	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA		Light Bulbs	Compact fluorescent light bulbs, T5 or T8 fluorescents, with electronic ballasts. Ballasts are electric "starters" required by certain lamp types, especially fluorescent lights.		C.3	
EA		Occupant Sensor Controls	Sensors that turn lights on and off based on the presence or absence of occupants, manual "on" automatic "off" controls. May include multi-level switching or dimming systems.	CI-EA.c1.2		7.4.6
EA		Timers	Timers that turn lights on and off based on time of day.	CI-EA.c1.2		7.4.6
EA		Photo sensors	Sensors that turn lights on and off based on the level of natural lighting.	CI-EA.c1.2		7.4.6
EA		HVAC Systems	High efficiency, properly sized HVAC systems (boilers, chillers, etc.) Features may include economizers, motorized dampers, special duct sealing, limitations on flexible duct work, duct distribution system with diffusers and registers, fan power limitations, compliance with energy recovery requirements, duct and pipe insulation standards, low-face velocity coils and filters, cold-air systems, multiple chillers with varying sizes, desiccant dehumidification, absorption cooling, hydronic pumping systems, heat exchangers. For multi-family buildings, use central heating instead of individual unit heating.	CI-EA.c1.3	C.2 C.3	7.4.3
EA		HVAC Controls	HVAC controls with time-of-day scheduling or temperature set back or full-building automation systems, occupant controls or occupant sensors. Zoned heating and cooling, fan and motor controls.	CI-EA.c1.3	C.2	7.4.3
EA		Thermal Energy Storage	Systems that make ice or chilled water during off-peak hours when power is less expensive then use the ice or chilled water to cool the building during peak hours. This is a load smoothing strategy, reducing peak load energy costs and the need to operate the dirtiest and most expensive power plants.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA		Variable Frequency Drives (VFDs) Variable Air Volumes (VAVs)	VFDs are fans and motors that operate on variable frequencies and rates on demand. VAVs modulate the flow of air rather than the temperature, thereby modulating the amount of heating or cooling effect that is delivered to the building through the HVAC system.	CI-EA.c1.3		
EA		Energy Management & Control Systems	Manual or automatic controls for elements of the building that consume energy.			
EA	On-Site Renewable Energy	On-Site Renewable Energy - General	One or more of a variety of systems that generate electricity or other forms of energy on site. See below for potential features. CR, CR Net Metering is a metering and billing arrangement that allows on-site generators to send excess electricity flows to the regional power grid. These electricity flows offset a portion of the electricity flows drawn from the grid.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Photovoltaic Systems	Panels comprised of semi-conductor devices called solar cells convert solar energy into electricity.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Passive Solar Systems	Architectural elements that collect, store and distribute solar energy for heating, cooling and daylighting.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Solar Thermal or Active Solar Systems	Solar energy used for water heating, pool heating, ventilation air preheat and space heating systems.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA	On-Site Renewable Energy	Biofuel Based Electrical Systems	Generators powered by fuels derived from biological sources.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Geothermal Heating/Cooling Systems	Using the heat of the earth for building applications such as heating. Using the cooling effect of naturally chilled water from a nearby lake to cool the building. (See ABN AMRO example in CORENET Global study.)	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Geothermal Electric Systems	These systems use the earths heat and underground hot water to make steam and spin turbines. When the water is not hot enough, a secondary liquid is used that boils at a lower temperature which is heated up by the hot water to create its own steam to spin turbines.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Low-Impact Hydro-electric Power Systems	Using dams to generate power with turbines while creating a dam that also has as small of an impact on the surrounding nature as possible.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Wave and Tidal Power Systems	Using the waves and tides of the ocean to spin turbines either underwater or right on the shore. The currents of the ocean are created by the winds, both are renewable.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Biomass	Biomass is plant material such as trees, grasses and crops that can be converted into heat energy to produce electricity.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA	On-Site Renewable Energy	Biogas Strategies		NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Wind Power	Wind-turbine generators.	NC-EA.c2 EB-EA.c2 CS-EA.c2 CI-SS.c1	C.4	7.3.3 7.4.3
EA	On-Site Renewable Energy	Elevator Generators	Elevators designed to generate electricity when moving downward.			
EA	Enhanced Commissioning	Enhanced Commissioning	Additional commissioning with particular attention paid to new or uncommon sustainable design features that may have a potential to be over-ridden, removed or otherwise used inefficiently because of the lack of understanding.	NC-EA.c3 CS-EA.c3 CI-EA.c2	A.3	10.3.1
EA	Enhanced Refrigerant Management	Enhanced Refrigerant Management	One option is to not use refrigerants at all. Another option is to select refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The LEED-NC requirement sets a maximum threshold for the combined contributions to ozone depletion and global warming potential. Where cooling equipment uses HCFC or HFC refrigerant, the mechanical room has a leak detection and alarm system.	NC-EA.c4 EB-EA.c4 CS-EA.c4	F.2	
EA	Measurement & Verification	Measurement & Verification	Develop a Measurement and Verification Plan to evaluate building and/or energy performance for a period of no less than one year of post-construction occupancy. Includes installing building-level utility meters to track and continuously optimize performance. Use EPA Energy Star Portfolio Manager Tool to benchmark energy performance.	NC-EA.c5 CS-EA.c5.1 CI-EA.c3		10.3.3.3 10.3.4

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA	Green Power	Green Power	Provide a portion of the building electricity (in the case of LEED-NC, at least 35%) from renewable sources by engaging in at least a two year renewable energy contract. Renewable sources are also referred to as green power and include energy derived from solar, wind, geothermal, biomass or low-impact hydro sources.	NC-EA.c6 EB-EA.c2 CS-EA.c6 CI-EA.c4	C.4	
EA	Building Operations and Maintenance	Staff Education	Arrange on-site or off-site training for building operations and maintenance staff that addresses building and building systems operation, maintenance and achieving sustainable building performance.	EB-EA.c3.1		
EA		Building Systems Maintenance	Have in place over the performance period a comprehensive Best Practices Equipment Preventative Maintenance Program that provides in-house resources or contractual services to deliver post-warranty maintenance.	EB-EA.c3.2		
EA		Building Systems Monitoring	Have in place over the performance period a system for continuous tracking and optimization of systems that regulate indoor comfort and the conditions (temperature, humidity and CO^2) delivered in occupied spaces.	EB-EA.c3.3		
EA	Performance Measurement	Enhanced Metering	Have in place over the performance period continuous metering for the following items: lighting systems and controls; separate building electric meters; separate building natural gas meters; separate meters that allow aggregation of all indoor occupants' related water use for required fixtures; separate meters that allow aggregation of all indoor process water use; separate meters that allow aggregation of all outdoor irrigation water use; chilled water system; cooling load; air and water economizer and heat recovery cycle operation; boiler; constant and variable motor loads; variable frequency drive (VFD); air distribution, static pressure and ventilation air volumes. Meters configured to communicate data to a meter data management system with hourly, daily, monthly and annual reporting capabilities for each meter.	EB-EA.c5.1-5.3 CI-EA.c3		7.3.4.1-3
EA		Emission Reduction Reporting	Track and record emission reductions delivered by energy efficiency, renewable energy and other building emission reduction actions. Report emission reductions using a third-party voluntary certification program. Can include holistic accounting of Greenhouse Gases through both direct sources	EB-EA.c5.4	F.1, F.2	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
			(fuel combustion, company owned vehicles) and indirect sources (purchased electricity, product use, production of purchased materials, outsourced activities, waste disposal and employee business travel).			
EA	Documenting Sustainable Building Cost Impacts		Document overall building operating costs for the previous five years (or length of building occupancy, if shorter), and track changes in overall building operating costs over the performance period.	EB-EA.c6		
EA	Measurement & Verification	Tenant Sub-metering	A centrally monitored electronic metering network included in the base building design that is capable of being expanded to accommodate future tenant sub-metering. Develop and implement a Measurement & Verification Plan that can be utilized and expanded by the tenant, which allows for comparisons of predicted savings and actual energy performance.	CS-EA.c5.2		7.3.4.1-3
EA	Optimize Energy Performance	Equipment & Appliances	Select energy-efficient equipment and appliances for the project (including appliances, heating and cooling, office equipment, electronics, lighting and commercial food service equipment) as qualified by the EPA's ENERGY STAR program or higher standard. Select ice cube machines, commercial refrigerators and freezers, commercial clothes washers, transformers and motors with minimum efficiencies (not covered by Energy Star).	CI-EA.c1.4		7.3.2.1 7.3.2.2 7.4.3 7.4.5
EA		LED Lighting	Use LED lighting where appropriate for exit signage, building and monument signage, grocery and display cases.			
EA		Energy Retrofits	Retro-fits include retro commissioning of mechanical, electrical and control systems, life cycle cost optimization for major HVAC, HVAC tune-up equipment, control upgrades, and smart thermostats.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EA		Expanded Demand Response	Property participates in the Critical Peak Demand Response Program. Participation may include meter installations, site audits to identify demand response strategies, the implementation of automatic demand response strategies through control systems, the development of manual load management strategies (i.e. precooling) and script strategies into work order systems. Also automatic systems to reduce the peak capacity of the building such as demand limiting or load shifting.			7.4.3 7.4.5
EA		Vertical Transport Energy Conservation	Building has the capability of shutting down elevators for part of the day and capability to slow down or stop escalators when detectors indicate no traffic.		C.2	
EA		Energy Efficiency - Building Size Limitation	The prescriptive option for ASHRAE 189P is to limit the size of dwelling units in multi-family residential building projects as follows: 900 sf for one bedroom units, 1,250 sf for two bedroom units, 1,700 sf for three bedroom units and 2,100 sf for units with four or more bedrooms.			7.4.1
EA		Water Heating Efficiency	Pipe insulation shall meet certain minimum requirements, pools heated to more than 90 degrees F shall have side and bottom surfaces insulated on the exterior with a minimum insulation value of R-2.1 (R-12).			7.4.4
EA	Condenser Heat Recovery	Condenser Heat Recovery	Supermarkets of 50,000 sf or greater shall have condenser waste heat recovery from freezers and coolers and shall use the waste heat for either for space heating, service water heating, or for dehumidification reheat for maintaining low space humidity.			7.4.7
EA		Waste Water Heat Recovery	Wastewater heat recovery from commercial dishwashers: hot water sanitizing (high temperature) dishwashers used in commercial food service operations shall provide wastewater heat recovery with a minimum energy recovery effectiveness of 30% of the available heat, to preheat domestic hot water make-up for the dishwasher or other uses.			7.4.7

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Materials & Resources						
MR	Storage & Collection of Recyclables and Discarded Goods	Storage & Collection of Recyclables and Discarded Goods	Provide an easily assessable area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling including (at a minimum) paper, corrugated cardboard, glass, plastics and metals. Other optional features include cardboard balers, aluminum can crushers, recycling chutes, and collection bins at individual workstations to further enhance the recycling program. Provide an easily accessible area dedicated to the collection and storage of discarded fluorescent lamps and ballasts. For building projects with residential areas, provide an easily accessible area dedicated to the collection and storage of discarded but clean items in good condition.	NC-MR.p1 EB-MR.p1.2 EB-MR.c5 CS-MR.p1 CI-MR.p1	E.5	8.3.4.1-3
MR	Building Reuse	Maintain a Portion of Existing Walls, Floors & Roof	Reuse of existing, previously occupied buildings, including structure, envelope and elements. Maintain a minimum amount (based on surface area) of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material). LEED-NC requirement is to maintain at least 75% or 95% for c1.1 and c1.2, respectively.	NC-MR.c1.1 & c1.2 CS-MR.c1.1-1.3	E.2, E.3	
MR	Building Reuse	Maintain a Portion of Interior Non-Structural Elements	Reuse of existing, previously occupied buildings including structure, envelope and interior non-structural elements. Accomplished by using existing interior non-structural elements (interior walls, doors, floor coverings and ceiling systems) in at least 50% for LEED-NC (by area) of the completed building, including additions.	NC-MR.c1.3 CI-MR.c1.2 & 1.3	E.2, E.3	
MR	Construction Waste Management	Divert Construction Waste from Disposal	Recycle cardboard, metal, brick, acoustical tiles, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Minimum of 50% or 75% for LEED-NC c2.1 and c2.2, respectively.	NC-MR.c2.1 EB-MR.c1 CS-MR.c2.1 & 2.2 CI-MR.c2.1 & 2.2	E.5	8.3.1

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
MR	Materials Reuse	Materials Reuse	Use salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick and decorative items. The LEED-NC requirement is to use salvaged, refurbished or reused materials such that the sum of these materials constitutes a minimum amount (based on cost) of the total value of materials on the project. (For LEED-NC, minimum is 5% for c3.1 and 10% for c3.2)	NC-MR.c3.1 & c3.2 CS-MR.c3 CI-MR.c3.1 & 3.2	E.2	
MR	Recycled Content	Minimum Recycled Content (post-consumer + 1/2 pre-consumer)	Use materials with recycled content such that the sum of post-consumer recycled content plus one half of the pre-consumer content constitutes a minimum amount (based on cost) of the total value of the materials in the project. The LEED-NC requirement is at least 10% for c4.1 or 20% for c4.2. Post-consumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process.	NC-MR.c4.1 & 4.2 CS-MR.c4.1 & 4.2 CI-MR.c4.1 & 4.2	E.1, E.2	8.4.1.1
MR	Regional Materials	Materials Extracted, Processed & Manufactured Regionally	Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site for a minimum of amount (based on cost) of the total materials value. LEED-NC requirement is a minimum of 10% for c5.1 and 20% for c5.2.	NC-MR.c5.1 & c5.2 CS-MR.c5.1 & 5.2 CI-MR.c5.1 & 5.2	E.1	8.4.1.2

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
MR	Rapidly Renewable or Biobased Materials	Rapidly Renewable or Biobased Materials	Portions of the building materials are rapidly renewable materials. Rapidly renewable materials are considered to be an agricultural product, both fiber and animal, that takes 10 years or less to grow or raise, and to harvest in an ongoing and sustainable fashion. Such materials include bamboo, wool, cotton insulation, agrifiber, linoleum, xxx marmoleum, sunflower board, xxx sorghum, wheatboard, strawboard, cork, strawbale and rubber. The LEED-NC requirement is to use rapidly renewable building materials and products for 2.5% of the total value of all building materials and products used in the project, based on cost.	NC-MR.c6 CI-MR.c6	E.1, E.2	8.4.1.3
MR	Certified Wood	Certified Wood	Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for wood building components. These components include, but are not limited to, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes. No wood from endangered wood species as listed by the Convention on International Trade in Endangered Species (CITES). CR, CR FSC was created in 1993 to establish international forest management standards (known as the FSC Principles and Criteria) to assure that forestry practices are environmentally responsible, socially beneficial and economically viable. The Principles and Criteria have been established to ensure the long-term health and productivity of forests for timber production, wildlife habitat, clean air and water supplies, climate stabilization, spiritual renewal and social benefit, such as lasting community employment derived from stable forestry operations.	NC-MR.c7 CS-MR.c6 CI-MR.c7	E.1, E.2	8.3.2
MR		Materials Non-Use	Exposed, painted or unpainted structural members and surfaces as opposed to finished ceilings, walls, etc.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
MR	Source Reduction and Waste Management	Waste Management Policy and Waste Stream Audit	Conduct a waste stream audit of the ongoing waste stream (not specific upgrade project waste) to establish a current building waste baseline that identifies the types of waste making up the waste stream and amounts of each type of waste in the waste stream. At a minimum, the audit should determine the amounts for paper, glass, plastics, cardboard and metals in the waste stream. Identify opportunities for source reduction and diversion. Operate over the performance period a waste reduction policy to reduce waste stream through source reduction purchasing strategies, collection station equipment, recycling and occupant education.	EB-MR.p1.1		
MR	Toxic Material Source Reduction	Reduced Mercury in Light Bulbs	Maintain mercury content of all mercury-containing light bulbs below 100 picograms (80 picograms for EB-MR.c6) per lumen hour, on weighted average, for all mercury-containing light bulbs acquired for the existing building and associated grounds.	EB-MR.p2 & c6		
MR	Optimize Use of Alternative Materials		Maintain a sustainable purchasing program covering at least office paper, office equipment, furniture, and furnishings and building materials for use in the building and on the site.	EB-MR.c2.1-2.5	A.2	
MR	Sustainable Cleaning Products and Materials		Implement sustainable purchasing for cleaning materials and products, disposable janitorial paper products and trash bags.	EB-MR.c4	A.2	
MR	Occupant Space, Long-Term Commitment		Occupants commit to remain in the same location for long periods of time (either 10-year tenancy or ownership of space, for LEED-CI).	CI-MR.c1.1		
MR	Resource Reuse	Furniture and Furnishings	Use of salvaged, refurbished or used furniture and furnishings for a portion of (a minimum of 30% for LEED-CI) the total furniture and furnishings budget, including case pieces, seating, filing systems, decorative lighting and accessories.	CI-MR.c3.3		

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
MR		Control of Rain Penetration	Specific measures are employed to meet the regional best practices to control rain penetration; such as overhangs, flashings, drainage planes that overlap flashing slopes, appropriately located and sized weep-holes.		E.4	
MR		Control of Entry of Ground Water	Measures have been employed to control the entry of ground water: such as slope, damp-proofing membrane, weeping tiles, and drainage along foundations.		E.4	
MR		Building Adaptability	The building design promotes adaptability in terms of the following: light fixtures are integrated within the planning grid or up-lighting is used rather than ceiling mounted lights, thereby avoiding the need to relocate ceiling fixtures; air diffusers are on flexible ducts that can be relocated at minimum cost; air exhaust ducts are flexible and are easy to connect and space, and capacity are available in ceiling and duct shafts to install special exhausts; cable/data is pre-wired in fixed locations and therefore does not require a technician for minor adjustments; floor-to-ceiling partition walls are easily removed and fully salvageable and can be relocated without damaging the flooring and with only minor damage to the ceiling; materials are of standard size and fastened using fastening systems that allow for easy disassembly including masonry, wood, timber, insulation, finishes, etc.		E.4	
MR		Life Cycle Assessment	A life cycle assessment has been performed as to a minimum of two building alternatives with common design, construction and materials for the locale.			8.5.1
MR		Materials and Resources - Measurement and Verification	Verify annually that areas for recyclables, reusable goods, and for fluorescent and HID lamps and ballasts are maintained.			10.3.3.4
MR		Durability Plan	A durability plan has been developed that is consistent with the owners project requirements and includes estimates of the structural, building envelope and hardscape materials that need to be replaced during the life of the building.			10.3.5

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Indoor Environmental Quality						
EQ	Minimum IAQ Performance	Minimum IAQ Performance	Design ventilation systems to meet or exceed minimum outdoor air ventilation rates as described in the ASHRAE 62.1-2004 Standard. Thermal, wind or diffusion effects through doors, windows or other intentional openings in the building provide natural ventilation. Mechanical ventilation is provided by mechanical powered equipment, such as motor-driven fans and blowers, but not including devices such as wind-driven turbine ventilators and mechanically operating windows. Mixed-mode ventilation combines natural ventilation with mechanical ventilation using one or the other at any given time or both simultaneously.	NC-EQ.p1 EB-EQ.p1 CS-EQ.p1 CI-EQ.p1	C.2, G.1	9.3.1
EQ	Environmental Tobacco Smoke (ETS) Control	Environmental Tobacco Smoke (ETS) Control	Prohibit or limit smoking in the building by locating any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows, locating designated smoking rooms to effectively contain, capture and remove ETS from the building. In residential buildings minimize uncontrolled pathways for ETS transfer between individual residential units by sealing penetrations in walls, ceilings and floors in the residential units. Also by sealing vertical chases adjacent to the units, and all doors in the residential units leading to common hallways shall be weather-stripped to minimize air leakage into the hallway. ETS consists of airborne particles emitted from the burning end of cigarettes, pipes and cigars and exhaled by smokers. These particles contain about 4,000 different compounds, up to 40 of which are known to cause cancer.	NC-EQ.p2 EB-EQ.p2 CS-EQ.p2 CI-EQ.p2		9.3.2

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Sustainable Property Features List

Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Outdoor Air Delivery Monitoring	Outdoor Air Delivery Monitoring	Install permanent monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Monitoring equipment is configured to generate an alarm when the conditions vary by 10% or more from set point, via either a building automation system alarm to the building operator, or via a visual or audible alert to the building occupants. For mechanically ventilated spaces, provide carbon dioxide monitoring and a direct outdoor airflow measurement device capable of measuring the minimum outdoor air flow rate. For naturally ventilated spaces provide carbon dioxide monitoring.	NC-EQ.c1 EB-EQ.c1 CS-EQ.c1 CI-EQ.c1	G.1	9.3.3 10.3.3.5
EQ	Increased Ventilation	Increased Ventilation	For mechanically ventilated spaces, increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by the ASHRAE standard. For naturally ventilated spaces, design natural ventilation systems for occupied spaces to meet the recommendations set forth in the Carbon Trust Good Practice Guide 237. Design the natural ventilation systems to meet the recommendations set forth in the CIBSE Applications Manual, Natural Ventilation in Non-domestic Buildings. The breathing zone is the region within an occupied space between planes that are three and six feet above the floor and more than two feet from the walls or fixed air-conditioning equipment.	NC-EQ.c2 EB-EQ.c2 CS-EQ.c2 CI-EQ.c2	G.1	
EQ		Under Floor Air Distribution (UFAD)	Placing ventilation systems under floors, usually combined with floor-by-floor air handling units, allows occupants superior comfort control on each floor.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Construction IAQ Management Plan	During Construction	During construction meet or exceed recommended control measures and guidelines for occupied buildings under construction. Protect stored onsite or installed absorptive materials from moisture damage (such as insulation, carpeting, ceiling tile and gypsum wallboard). Avoid using permanently installed air handlers for temporary heating/cooling during construction and, if used, replace all filtration media immediately prior to occupancy.	NC-EQ.c3.1 EB-EQ.c3 CS-EQ.c3 CI-EQ.c3.1	G.1	10.3.8 10.3.9.2
EQ	Construction IAQ Management Plan	Before Occupancy	Perform a building flush out by supplying a minimum total air volume to the building, after construction has been completed and prior to occupancy and with all interior finishes installed. May also be achieved by conducting baseline IAQ testing, after construction ends and prior to occupancy and according to certain testing protocols, and demonstrating that contaminant maximum concentrations are not exceeded. Chemical contaminants include formaldehyde, particulate matter, total volatile organic compounds (TVOC), 4-PCH (Phenylcyclohexene), and carbon monoxide (CO).	NC-EQ.c3.2 CI-EQ.c3.2	G.1	9.5.2 10.3.8
EQ	Low-Emitting Materials	Adhesives & Sealants	All adhesives and sealants used on the interior of the building comply with the requirements of various reference standards, generally referring to low-VOC materials used in construction. The products addressed generally include construction adhesives, flooring adhesives, fire-stopping sealants, caulking, duct sealants, plumbing adhesives, and cove base adhesives. CR, CR VOCs (volatile organic compounds) are carbon compounds that participate in atmospheric photochemical reactions. The compounds vaporize (become a gas) at normal room temperatures.	NC-EQ.c4.1 EB-MR.c3 CS-EQ.c4.1 CI-EQ.c4.1	A.2, G.2	9.4.2.1
EQ	Low-Emitting Materials	Paints & Coatings	All paints and coatings used on the interior of the building comply with specified criteria, generally referring to low-VOC materials used in construction.	NC-EQ.c4.2 EB-MR.c3 CS-EQ.c4.2 CI-EQ.c4.2	A.2, G.2	9.4.2.2

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Low-Emitting Materials	Carpet Systems and Hard Surface Flooring	All carpet installed in the building interior shall meet the testing and products requirements of the Carpet and Rug Institute's Green Label Plus program. All carpet cushion installed in the building interior shall meet the testing and products requirements of the Carpet and Rug Institute's Green Label program. Hard surface flooring materials have been tested and have been shown to be compliant with certain requirements or are third-party certified.	NC-EQ.c4.3 EB-MR.c3 CS-EQ.c4.3 CI-EQ.c4.3	A.2, G.2	9.4.2.3
EQ	Low-Emitting Materials	Composite Wood & Agrifiber Products	Composite wood and agrifiber products used on the interior of the building, the laminating adhesives used to fabricate onsite, and shop-applied composite wood and agrifiber assemblies shall contain no added urea-formaldehyde resins. Composite wood and agrifiber products are defined to include particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores. Furniture and equipment are not considered base building elements and are not included. Urea-formaldehyde is a combination of urea and formaldehyde that is used in some glues and may emit formaldehyde at room temperature. Composite wood is a product consisting of wood or plant particles or fibers bonded together by synthetic resin or binder.	NC-EQ.c4.4 EB-MR.c3 CS-EQ.c4.4 CI-EQ.c4.4	A.2, G.2	9.4.2.4
EQ	Indoor Chemical & Pollutant Source Control	Indoor Chemical & Pollutant Source Control	Install grates, grilles, or slotted systems in entryways to prevent occupant-borne contaminants from entering the building. In areas where hazardous gases or chemicals may be present or used (including garages, housekeeping/laundry areas and copying/printing rooms), exhaust each space sufficiently to create negative pressure with respect to adjacent spaces with the doors to the room closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard lid ceiling. Also, install high-level filtration systems and air-handling units processing both return air and outside supply air. Provide storage for flammable materials with fire-rated walls and doors and fire-dampered outlets.	NC-EQ.c5 EB-EQ.c10.1 & 10.2 CS-EQ.c5 CI-EQ.c5	F.6, G.2	9.3.5

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Controllability of Systems	Lighting	Individual lighting controls for the building occupants (minimum of 90% for LEED-NC) to enable adjustments to suit individual task needs and preferences. Provide lighting system controllability for all shared multi-occupant spaces to enable lighting adjustment that meets group needs and preferences. Elements include uniform general ambient lighting and individually controlled task fixtures.	NC-EQ.c6.1 EB-EQ.c6.1 CI-EQ.c6.1		
EQ	Controllability of Systems	Thermal Comfort	Provide individual comfort controls for building occupants (a minimum of 50% for LEED-NC) to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controls for occupants in certain areas. Also provide comfort system controls for all shared multi-occupant spaces to enable adjustments to suit group needs and preferences. Comfort system control is defined as the provision of control over one or more of the primary factors in the occupant's local environment: air temperature, radiant temperature, air speed and humidity.	NC-EQ.c6.2 EB-EQ.c6.2 CS-EQ.c6 CI-EQ.c6.2	G.4	9.3.4
EQ	Thermal Comfort	Design and Compliance	HVAC systems and the building envelope are designed to meet minimum requirements of ASHRAE. Thermal comfort is a condition of mind experienced by building occupants expressing satisfaction with the thermal environment.	NC-EQ.c7.1 EB-EQ.c7.1 CS-EQ.c7 CI-EQ.c7.1		
EQ	Thermal Comfort	Verification and Monitoring	Implement a thermal comfort survey of building occupants (for LEED-NC, within a period of 6-18 months after occupancy) or analyze environmental variables. The survey should collect anonymous responses about thermal comfort in the building including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Develop a plan for collective action if the survey results indicate that (for LEED-NC, more than 20% of) occupants are dissatisfied with thermal comfort in the building.	NC-EQ.c7.2 EB-EQ.c7.2 CI-EQ.c7.2		

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Daylight & Views	Daylight a Portion of Spaces	Generally involves designing the building to maximize interior daylighting. Also may include limitations on glare. See below for specific individual features. Daylighting is the controlled admission of natural light into a space through glazing with the intent of reducing or eliminating electric lighting. By utilizing solar light, daylighting creates a stimulating and productive environment for building occupants. The LEED-NC requirement is for one of three measures of daylighting to be achieved for 75% of all regularly occupied areas: 1) a minimum glazing factor, 2) demonstration through computer simulation or 3) demonstration through records of indoor light measurements that a minimum daylight illumination level of 25 foot candles has been achieved in at least 75% of all regularly occupied areas.	NC-EQ.c8.1 EB-EQ.c8.1 & 8.2 CS-EQ.c8.1 CI-EQ.c8.1 & 8.2	G.3	9.3.7 9.5.1.1 9.5.1.2
EQ		Building Orientation			C.2	
EQ		Shallow Floor Plates				
EQ		Increased Building Perimeter	Building design with greater perimeter and work areas located along perimeter allows for greater benefits from daylighting.		C.2	
EQ		Exterior and Interior Permanent Shading Devices	See Energy & Atmosphere.		C.2	9.4.1.2
EQ		High Performance Glazing	See Energy & Atmosphere.		C.2	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ		Automatic Photocell-based Controls	See Energy & Atmosphere.			
EQ	Daylight & Views	Views for a Portion of Spaces	Achieve direct line of sight to the outdoor environment via vision glazing between 2.5 and 7.5 feet above finish floor for building occupants in regularly occupied areas (90% for LEED-NC). Vision glazing is that portion of exterior windows above 2.5 feet and below 7.5 feet that permits a view to the outside of the project space.	NC-EQ.c8.2 EB-EQ.c8.3 & 8.4 CS-EQ.c8.2 CI-EQ.c8.3	G.3	
EQ	Asbestos Removal or Encapsulation	Asbestos Removal or Encapsulation	Have in place an asbestos management program. Identify the applicable regulatory requirements. Have survey records that identify where asbestos is located in the building and on the site so that the asbestos present can be addressed appropriately in the ongoing asbestos management program.	EB-EQ.p3	F.4	
EQ	Polychlorinated Biphenyl (PCB) Removal	Polychlorinated Biphenyl (PCB) Removal	Have in place a PCB management program. Identify the applicable regulatory requirements. Have a current survey that identifies where PCBs are located in the building and on the site so that the PCBs present can be addressed appropriately in the ongoing PCB management program.	EB-EQ.p4	F.4	
EQ	Documenting Productivity Impacts	Absenteeism and Health Care Cost Impacts	Document the history of absenteeism and health care costs for building occupants for the previous five years (or length of building occupancy with a minimum of 12 months). Track changes in absenteeism and health care costs for building occupants over the performance period relative to sustainable building performance improvements.	EB-EQ.c4.1		
EQ	Documenting Productivity Impacts	Other Productivity Impacts	Document the other productivity impacts (beyond those identified in IEQ Credit 4.1 Absenteeism and Health Care Cost Impacts) of sustainable building performance improvements for building occupants. Address and track changes in the impact on the amount of work done and errors made or other productivity impacts for building occupants over the performance period relative to sustainable building performance improvements. This documentation needs to be provided for the previous five years (or length of building occupancy with a minimum of 12 months).	EB-EQ.c4.2		

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ	Indoor Chemical and Pollutant Source Control	Non-Cleaning System - Reduce Particulates in Air Distribution	Have filters with particle removal effectiveness MERV 13 or greater in place over the performance period for all outside air intakes and for the returns for the re-circulation of inside air. Establish and follow a regular schedule for maintenance and replacement of these filters. Outdoor air intakes protected with screens and located at least 20 feet away from exhaust outlets and 60 feet away from pollution sources such as parking areas, driveways, etc. Prevent water from ponding near outdoor air intakes. All outdoor air, return air and supply air systems consist of steel ductwork. Also may include filters for ozone and volatile organic compounds (VOCs).	EB-EQ.c5.1	G.1	
EQ	Indoor Chemical and Pollutant Source Control	Non-Cleaning-Isolation of High-Volume Copying/Print Rooms/Fax Stations	Have in place over the performance period structural deck-to-deck partition with separate outside exhausting, no air re-circulation and negative pressure to contain and isolate high volume copying/print rooms/fax stations. High volume means any copy machine, print or fax station with a monthly copy usage of more than 40,000 pages. This credit can also be earned by putting all copiers, printers, and fax machines exceeding a lower monthly capacity or usage threshold (selected by the building owner) in isolated, separately ventilated rooms.	EB-EQ.c5.2		
EQ	Contemporary IAQ Practice		Develop and implement on an ongoing basis an IAQ management program for buildings based on the EPA document "Building Air Quality: A Guide for Building Owners and Facility Managers," EPA Reference Number 402-F-91-102, December 1991, which is available on the EPA Web site, www.epa.gob/iaq/largebldgs/graphics/iaq.pdf.	EB-EQ.c9		
EQ	Green Cleaning	Low Environmental Impact Cleaning Policy	Have in place over the performance period a low-impact environmental cleaning products, equipment and housekeeping policy that addresses sustainable cleaning and hard flooring coating systems products and utilization of concentrated cleaning products. Floor coating products that are free of zinc are preferred.	EB-EQ.c10.3	A.2	
EQ	Green Cleaning	Low Environmental Impact Pest Management	Develop, implement and maintain a low environmental impact integrated indoor pest management policy.	EB-EQ.c10.4-5	A.2, F.5	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
		Policy				
EQ	Green Cleaning	Low Environmental Impact Cleaning Equipment Policy	Implement a policy for the use of janitorial equipment that maximizes effective reduction of building contaminants with minimum environmental impact.	EB-EQ.c10.6	A.2	
EQ	Low-Emitting Materials	Systems Furniture and Seating	All systems furniture and seating introduced into the project space that has been manufactured, refinished or refurbished within one year prior to occupancy must meet certain emission requirements. For LEED-CI, this requirement can be satisfied by using Greenguard Indoor Air Quality Certified products or by ensuring that indoor air concentrations of TVOC, Formaldehyde, Total Aldehydes and 4-PCH are within specified limits. Systems furniture is defined as either a panel-based workstation comprised of modular interconnecting panels, hang-on components and drawer/filing components or a free-standing grouping of furniture items and their components that have been designed to work in concert.	CI-EQ.c4.5		
EQ		Storage Tank Safety	Storage tanks have various safety features: above ground or "day tanks" have secondary containment, fuel oil storage tanks are non-metallic double walled or are contained in lined vaults, there is a detection system with monitors and alarms for tanks and piping.		F.4	
EQ		Prevention of Harmful Chemicals and Gases	Measures are in place to prevent the accumulation of harmful chemicals and gases such as Radon and Methane in spaces below the substructure, and their penetration into the building.		F.4	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
EQ		Avoidance of Micro-organisms	The humidification system has features to avoid the growth of micro-organisms: there is steam humidification, or in special applications ultrasonic humidification; water or steam humidification originates directly from a potable source or from a source with equal or better water quality; drain pans for dehumidifying cooling coils provide adequate slope.		G.2	
EQ		Carbon Monoxide Monitoring	Carbon monoxide monitoring in parking garages and areas where there is combustion such as boiler rooms.		G.2	
EQ		Avoidance of Microbial Contamination	Measures are in place to minimize microbial contamination from cooling towers and in the domestic hot water system. There are no wet cooling towers, or wet cooling towers have high-efficiency drift eliminators and covers to block sunlight penetration, or wet cooling towers have no side air louvers nor open basins. Piping is not capped and there are no dead legs or long pipe runs, and collection tanks avoid the risk of stagnation; the system is designed to maintain hot water at or above 131 degrees F and cold water below 77 degrees F.		G.2	
EQ		Acoustic Comfort	Where sound levels at the property line exceed 65 decibels, the building is sited and spaces within the building are zoned so as to provide optimum protection from undesirable outside noises. Sound Transmission Class (STC) levels specified for the building envelope correspond to the functional needs of the spaces. Noise attenuation of the structural systems and measures to insulate primary spaces from impact noise are in place. The interior design meets specified ambient noise levels for the various occupancies (single occupancy cellular offices, multi-occupancy open plan offices, etc.). Measures are in place to mitigate acoustic problems associated with mechanical equipment and plumbing systems. (For example positioning mechanical systems and noise generating equipment on foundations that are isolated from the building super structure; positioning ducts appropriately and enclosing them in sound isolation materials; sound-proofing mechanical rooms; using acoustic zoning to separate quiet areas from noisy machinery;		G.5	

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
			and selecting systems for their sound qualities).			
Innovation in Design Process, Upgrades, Operations and Maintenance						
ID	Innovation in Design	Innovation in Design	Design strategies that 1) greatly exceed the requirements of existing LEED credits or 2) are not addressed by any existing LEED credits.	NC-ID.c1.1-4 EB-ID.c1.1-4 CS-ID.c1.1-4 CI-ID.c1.1-4	A.1	
ID		Innovation in Upgrades, Operations and Maintenance	Upgrades, operations and maintenance. Strategies that 1) greatly exceed the requirements of existing LEED credits or 2) are not addressed by any existing LEED credits.	EB-ID.c1.1-4		
ID	LEED Accredited Professional	LEED Accredited Professional	At least one principal member of the project team is a LEED Accredited Professional (AP).	NC-ID.c2 EB-ID.c2 CS-ID.c2 CI-ID.c2		
Operations and Maintenance						
OM		Building Functioning as Designed	Regular inspection of equipment and controls (including Energy Management and Control Systems - EMS or EMCS) to ensure they are functioning as designed; calibrate thermostats, adjust dampers, adjust set points, etc.	BOMA		
OM		Janitorial Best Practices	Team cleaning, clean windows and skylights.	BOMA		
OM		Day Cleaning	Have janitorial staff conduct cleaning during work and/or daylight hours to avoid additional energy consumption.	BOMA		

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
OM		Sweeps	Janitorial or security staff conduct sweeps as part of their rounds to ensure that unnecessary lights, task lights, appliances, machines, kitchen equipment, etc are turned off.	BOMA		
OM		HVAC Maintenance	Replace filters, clean coils and seal duct risers to remedy leaks that may be caused by seasonal contraction and expansion.	BOMA		
OM		Delamp	Delamp and disconnect unused ballasts.	BOMA		
OM		Full Floor Lighting Sweeps	Program and periodically verify that the EMS system is performing full floor lighting sweeps.	BOMA		
OM		Adjust Temperature Set Points	Walk through building and ask occupants if actual temperature is comfortable. Consider seasonal changes with lower set points in winter months and higher set points in summers months.	BOMA		
OM		Ventilation Controls	Adjust ventilation rates in low-occupancy or unoccupied spaces.	BOMA		
OM		Thermostat Controls	Limit access to thermostats using EMS controls, tamper-proof locking covers or locking screws.	BOMA		
OM		Heat Recovery Equipment	Heat recovery equipment such as enthalpy wheels and heat pipes, to optimize conditioning of ventilated air.	BOMA		
OM		Thermostat Location	Relocate thermostats to optimal locations near return air ducts.	BOMA		
OM		Systems Start/Stop Management	Adjust unit/plant start times to stagger start-up demand, and adjust stop times to reduce operating hours. "Coast" during last hour of operations. Consideration should be given to hours of services stipulated in leases, outside weather conditions and demand billing structure of the utility.	BOMA		
OM		After Hours Lighting Control	After hours, turn off as much common-area lighting as possible, such as bathrooms, corridors and lobbies, without sacrificing security.	BOMA		

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
Miscellaneous						
		Integrated Design	A collaborative, integrated planning and design process that incorporates an integrated project team in all stages of the project, establishes performance goals throughout the design and lifecycle of the building, and considers all stages of the building's lifecycle, including deconstruction.	MOU	A.1	
		Vastu Shastra	A building design philosophy that focuses on building orientation, facing east to take advantage of the energy of the rising sun.			
		Feng Shui	A system for the harmonious placement of buildings on a site, site selection and lot layout.			
		Moisture Control	Control moisture flows and condensation to prevent building damage and mold contamination.	MOU	G.2	
		Tenant Handbook	Handbook with recommendations for sustainable design and construction technologies. Encourage tenants to power down everything at the end of the day, including copiers, kitchen equipment and task lights. Encourage tenants to use ENERGY STAR equipment such as computers, copiers, external power adapters, fax machines, laptops, monitors, multifunction devices, printers, scanners, water coolers, etc. and to use power management software for computer monitors.			
		Water & Sewer Consumption Tracking Systems	Established a water and sewer consumption tracking system that will allow for the establishment of a baseline and comparison to actual performance over time.			
		Socially Responsible Suppliers	Select suppliers that meet certain Corporate Social Responsibility standards such as code of conduct, documentation of chemical use, documentation of hazardous waste handling, recycled content of products, and documentation of steps being taken to reduce environmental impact.			

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Cate-gory	Sub-Category	Sub-Feature	Description	LEED Reference	Green Globes Reference	ASHRAE 189P Reference
		IT & Electronic Recycling	Establish a portfolio-wide IT equipment recycling program including the following; comprehensive use of computer recycling providers and donation programs to provide computers to schools and aide programs.			

Appendix III-B
Preliminary Analysis of Existing Case Study Databases Relevant to Green Buildings

Introduction

This early 2007 memo includes a review of a select number of the larger and more widely known sources of case study information records based on the GBFC's preliminary research into the various sources and collections of case study information relevant to "green building projects." Please check Consortium Research Library and Industry Links code 15.2 for further updates of case study data.

Generally speaking, there are two types of case studies: 1) General case studies which examine many different aspects of a green building; and 2) Specialized case studies that examine a particular green building feature or attribute – typically in more detail than in the general green building case studies.

Examples of general green building case studies include DOE's High Performance database, BuildingGreen.com's database, AIA/COTE's database, and the USGBC's database. Examples of specialized databases include Carnegie Mellon's case studies that focus on worker productivity issues, and Energy Star's Portfolio Manager Database and BOMA's BEEP case studies that focus on issues related to energy efficiency. There are also scores of other case studies and targeted research available on various company and organization websites which we do not record here, as well as key data and information in academic and company research studies, tenant surveys, and other sources of data that will also be key to supporting the business case and valuation of green buildings which we do not cover in this document.

A brief summary and weblink to each of the databases reviewed by the GBFC follows below. Many of the databases are free; however, we have attempted to note cost information where subscription or other fees apply.

1. Department of Energy's High Performance Building Database

The DOE's case study database contains detailed information on 92 high performance buildings. Projects range in size from small single-family homes or tenant fit-outs within buildings to large commercial and institutional buildings or entire campuses.

Project information reported in the DOE high performance building database follows a similar format to several of the other prominent "green building" case study databases, including the USGBC's, BuildingGreen.com, and AIA/COTE's. This format includes the

following 12 categories: overview, process, finance, land use, site/water, energy, materials, indoor environment, images, ratings and awards, lessons learned, and learn more. The DOE has funded a number of the case study databases maintained by the various organizations and clearly there has been an effort to coordinate the collection and reporting of "green building" case study information.

Despite this attempt at uniformity, information reported, tends to vary from project to project. Some of this variation is due to property-type differences and other variation is likely due to differences in the way information is collected and reported by the individual project sponsors.

Access to the database is free and can be found on the web at: http://www.eere.energy.gov/buildings/database/mtxview.cfm?CFID=10362633&CFTOKEN=85631558

2. BuildingGreen.com case studies

The BuildingGreen.com database contains detailed information on 162 high performance buildings, 67 of which are LEED certified. The information collected follows the same 12-category format as the DOE's database and it appears that the database also includes the 92 case studies from the DOE database. As is the case with the DOE case studies, the project descriptions do not report exactly the same information for each building and may or may not include details on various aspects of its design process, costs, and/or environmental performance.

Access to the database is by subscription which for a single-user costs $199 per year or can be accessed for a one-week subscription cost of $12.95. The database can be found on the web at: http://www.buildinggreen.com/hpb/

3. The US Green Building Council (USGBC)

The USGBC maintains a list of both certified and registered LEED projects. The distinction being that "certified" projects are those that have actually received a LEED certification while "registered" projects are those that have stated an intention to pursue a LEED certification. The USGBC's database contains basic information (i.e. project name, owner, location, owner type, square footage, and relevant LEED standard) on some 605 certified projects and 1,915 registered projects. It should be noted that the number of registered projects reporting basic data is a fraction of the more 6,000 registered projects, presumably because the USGBC has not received permission form the project sponsor to make this information available.

The USGBC's detailed case study database is a considerably smaller subset of the project lists, containing some 57 LEED certified projects. There is some overlap between the USGBC case studies with the DOE and BuildingGreen.com. The case study information follows a similar 12-category format that used by the DOE, BuildingGreen.com and

AIA/COTE. It is not clear if there are any detailed case studies for buildings that are simply LEED "registered."

Access to the database is free and can be found on the web at:
http://www.usgbc.org/DisplayPage.aspx?CMSPageID=1452&

4. AIA/COTE Top Ten Green Projects

The AIA/COTE Top Ten Green Projects database contains detailed information on 56 projects (10 per year from 2003 through 2006, and 16 from years prior to 2003). The case studies follow a similar 12-category format to those from the DOE, the USGBC, BuildingGreen.com and others.

Additional detailed information on project design ("Boards") and a lengthy quantitative and qualitative write-up entitled, "ten measures and supporting metrics" is provided for each project. The case studies in this database appear more concentrated on public buildings and residential projects than some of the others.

Access to the database is free and can be found on the web at:
http://www.aiatopten.org/hpb/index.cfm

5. CoreNet Global's Knowledge Center

CoreNet's Knowledge Center contains a number of case studies of interest to its corporate real estate owner membership. The case studies are organized around a series of topics relevant to its membership whose interests are not solely focused on sustainable buildings. Some of the topic areas where sustainability and other corporate real estate user interests intersect, and where case studies are available, include: Benchmarking; Change Management; Facilities Management; Financial Management; Project Management; Portfolio Management; Sustainability; and Transactions Management.

Case Studies and other information in CoreNet's Knowledge Center are accessible on a restricted basis. While some basic documents and information are free, the bulk of the information is restricted by a user passport level, ranging from 1 to 4. The higher the passport level, the greater the access and the greater the financial and/or participatory commitment by the user. Most of the case studies require a level 3 passport which is only available to "Learning Partners" on a subscription basis.

CoreNet's Knowledge Center can be found on the web at:
http://www2.corenetglobal.org/knowledge_center/index.vsp

6. Center for Building Performance and Diagnostics (CBPD), Carnegie Mellon School of Architecture

The CBPD indicates that it has collected some 250 case studies of various types including building case studies, field experiments, controlled experiments, etc. that link some aspect

of high performance buildings (e.g. daylight, lighting, improved ventilation, individual thermal control, etc.) to health, productivity, energy savings, employee turnover and other cost-benefit areas. The CBPD's BIDS (Building Investment Decision Support) tool is being developed for the purpose of facilitating public and private sector investment in better buildings. The BIDS tool itself and its contents (including case studies) are restricted to members of its funding consortium.

More information about the CBPD and its BIDS tool can be found at:
http://www.arc.cmu.edu/cbpd/projects/index.html

7. BOMA Energy Efficiency Program (BEEP) Case Studies

As part of its Energy Efficiency Program (BEEP), BOMA collects and uses case study information in connection with its seminar program. The 6 seminars are each two hours long, cover a different topic related to energy efficiency, and cost $99 per site for BOMA members and $125 per site for non-members. The case study information submitted by participants in the program is integrated into the seminars.

Additional information about the BEEP seminar program can be found at:
http://www.boma.org/TrainingAndEducation/BEEP/

8. Rocky Mountain Institute Case Studies

The Rocky Mountain Institute sells a *Green Developments 2.0 CD ROM* for $20.00 and a supplemental *Green Development Book* for $70.00 on its website. The CD ROM contains over 200 case studies. According to the RMI website these materials were partially funded by the USDOE and may therefore have some overlap with the DOE case study database. Sample case studies on the website appear to be fairly detailed, but it is not clear whether they follow the same format as those of the DOE, the USGBC, AIA/COTE, or BuildingGreen.com. The RMI case studies include a number of green projects outside of the US.

The weblink to order the CD ROM or Green Development Book is:
Green Developments 2.0 CD-ROM - RMI Publications

9. RICS Canada Green Value Case Studies

The RICS Canada Green Value Case Studies database contains approximately 12 detailed case studies. Most of these case studies are Canadian projects and a combination of residential, office, retail and educational/research facilities. The case studies are approximately 5 to 7 pages each and follow a similar format, discussing the special or unique features of each project. Each case study includes the following sections: Summary of Interview, General, Environmental, Social, and Financial. The case studies were published in 2005 and we are not aware of any ongoing effort by RICS to collect and publish additional case studies.

The RICS Green Value Case Studies are free and a PDF file can be downloaded from the RICS Canada website at:
http://www.rics.org/site/scripts/documents_info.aspx?documentID=248&pageNumber=3

10. Green Building Alliance Case Studies

The Green Building Alliance Case Studies database contains information on 46, Pittsburgh-area (primarily), LEED certified and other buildings incorporating "green features." The case studies are approximately a single page in bullet point format and are generally not as detailed as other case study sources including the USGBC's, DOE's and BuildingGreen.com.

Access to the database is free and can be found on the web at:
http://www.gbapgh.org/casestudies_main.asp

11. Turner Construction Webpage

The Turner Construction website highlights 15 LEED projects and 18 "Green" projects on its website. Turner provides several images and a brief write-up that includes basic metrics (SF, # of stories, location) for the project, some of its green features, the architect, etc. Turner has some involvement with each of the projects highlighted.

Access to the database is free and can be found on the web at:
http://www.turnerconstruction.com/greenbuildings/content.asp?d=4139

12. California Integrated Waste Management Board (CIWMB) Case Studies

The CIWMB website contains a combination of internally generated information and links to other websites for approximately 40 "green building" case studies. The projects are all located in California and are a combination of commercial, residential, educational, and public facilities. The case studies are mostly in a single page format and frequently have project contact links or links to other websites containing additional project information. The case studies are generally not as detailed as other case study sources including the USGBC's, DOE's, AIA/COTE's and BuildingGreen.com.

Access to the database is free and can be found on the web at:
http://www.ciwmb.ca.gov/greenBuilding/CaseStudies/Name.htm

Appendix III-C
Comprehensive Building Performance Rating Tools in North America

	LEED USA	LEED Canada	Green Globes	Go Green Plus	SBTool
Organization	USGBC, about 6-8,000 organizational members	CaGBC; 1100+ organizational members	Green Building Initiative, about 35 organizational members	BOMA Canada	iiSBE
Occupancy types covered	• LEED New Construction 2.2 • LEED Existing Buildings • LEED Commercial Interiors • LEED Core and Shell • LEED Homes • LEED Nbhd Development	• LEED Canada NC 1.0 • LEED Canada CI • LEED Campus & Multiple Buildings	• Design: New Construction, Commercial Interiors, Historic • Mgmt / Ops: Offices, MURB, Light Industrial, Historic • Community Emergency Planning • Building Intelligence: Communications, Security	Office and institutional buildings	3 Residential types, 13 non-residential types available. A total of 1 Residential and 2 non-residential can be selected.
Scope	For New Construction: • Site selection • Water efficiency • Energy and atmosphere • Materials and Resources • Indoor Environmental Quality • Innovation and Design Process		• Project Management • Site • Energy • Water • Resources • Emissions, Effluents, Impacts • Indoor Environment	• Energy • Water • Resources • Emissions, Effluents, other impacts • Indoor environment • Environmental management	
Phases covered	Each LEED tool covers a separate phase		Design, Operations	Operations	
Scoring system	69-point scale with 4 levels of achievement for NC		1000-point scale		
Weighting system	Fixed (embedded in points system)		Fixed (embedded in points system)	Fixed (embedded in points system)	
Benchmarking system	Fixed		Fixed	Fixed	
Adaptation to regional conditions	Core elements cannot be changed but regions and licensee countries can negotiate supp. conditions	Energy benchmark tied to MNECB, additional criterion for Durability, otherwise similar to U.S. LEED	Fixed structure and scoring.	Fixed structure and scoring.	• Weights adjustable • Benchmarks adjustable • Local Content can be substituted • Local Language can be substituted

Appendix III-C
Comprehensive Building Performance Rating Tools in North America

	LEED USA	LEED Canada	Green Globes	Go Green Plus	SBTool
Assessment protocol	Documentation submitted online or hardcopy for independent verification		Initial web-based self-assessment; Optional third-party assessment	Web-based questionnaires	
Training	Training from introductory to advanced, accreditation available through exam		Training available		
Reporting	• Relative performance • Absolute performance		• Relative performance • Absolute performance • Action recommendations		
System notes and implementation	Online system for assessment, calculation and documentation support. Current LEED tools do not deal with greenhouse gas emissions or full life cycle analysis.		Web-based system. Deals with LCA and provides design advice at early stages.	Web-based systems for operations stage	
Activity level	462 certified and 3,757 registered projects	240 registered projects + 38 old US LEED projects		NA	In Canada and USA, available for R&D purposes. Some commercial activity in other countries.
Comments	Extensive committee structure allows consensus-based decisions	Planning to develop "LEED Complete" v. 3.0	User responds to questions on web, then submission of docs; Web system includes links to other supporting sites		Excel system includes links to other supporting sites

Source: *Nils K. Larsson, Jean Cinq-Mars, Joel-Ann Todd, Gary Sharp, "A Study of Green Building in North America, Phase 1: Background, History, Issues and National Overviews," Carried out for the CEC Secretariat by The International Initiative for a Sustainable Built Environment, May 30, 2006*

Appendix III-D

Measuring Sustainability: Assessment Systems/Tools

Category	Number
A. Building Environmental Certifications	33
B. Occupier-Focused Assessments	6
C. Government Regulations and Assessment Systems	7
D. Other Building Performance Assessments and Standards	7
E. Product/Material Assessments and Certifications	34
F. Service Provider Assessments and Certifications	
Total	**88**

Appendix III-D: Measuring Sustainability: Assessment Systems/Tools

System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
A. Building Environmental Assessments/Certifications			
1. Leadership in Energy and Environmental Design (LEED)	US Green Building Council http://www.usgbc.org	United States/ International	LEED is the most established green building rating system in the US. It is frequently cited in government building standards and has gained wider international recognition, in recent years. LEED has recently been enhanced, with significant changes, and is designed to evolve over time. This certification has strong market appeal and contributes significant value beyond the contribution of a building's sustainability features. LEED V 3, which includes an update (LEED 2009), revised certification process, and improved on-line certification, is nearly complete.
2. Green Globes US	Green Building Initiative http://www.thegbi.org/green-globes-tools/	United States	The Green Globes rating system in the US is based on a score derived from seven categories designed to assess a project's environmental performance. The Green Globes ratings system is generally considered less time consuming and less expensive to implement compared to LEED, allowing for, but not requiring verification. Green Globes has not achieved the value or market

Appendix III-D: Measuring Sustainability: Assessment Systems/Tools

System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			share of LEED.
3. ASHRAE 189P	ASHRAE http://www.ashrae.org	United States	LEED was not designed to be a building code and so, in 2006, the US Green Building Council began working with ASHRAE, IESNA, and the AIA on the creation of Standard 189. Unlike LEED, Standard 189 is written in enforceable language that could be incorporated into building codes in much the same way ASHRAE 90.1 and the EICC standards are today. Standard 189 also directly tackled three major challenges for standards and rating systems. Unlike LEED and other point-based rating systems, most of the standard is made up of criteria that cannot be traded off, so that a building cannot pass unless it shows strong performance in each of the categories. Lastly, Standard 189 was designed to address the bothersome gap between modeled and actual performance by requiring measurement and verification for 12 to 18 months after occupancy and requiring commissioning if the building fails to achieve an efficiency target benchmarked through US EPA's EnergyStar Portfolio Manager.
4. National Green Building Standard	National Association of Home Builders (NAHB)/International Code Council (ICC) http://www.nahbgreen.org/Guidelines/default.aspx	United States	This standard applies to single-family construction, remodeling, and multi-family construction. It uses a point system that ranges from a minimum of 279 points for bronze through four levels to emerald, which requires a minimum of 625 points. The National Green Building Standard is currently under review by the American National Standards Institute (ANSI). Based on the *NAHB Model Green Home Building Guidelines*, the draft was developed according to the ANSI consensus process, by a committee of industry stakeholders led by NAHB and the International Code Council.
5. Green Communities Criteria	Enterprise http://www.greencommunitiesonline.org/tools/criteria	United States	The Green Communities Criteria endeavor to provide a clear cost effective framework for affordable housing. Projects that meet criteria (mandatory criteria plus 35 optional points) are eligible for funding.
6. BOMA Go Green	BOMA Canada	Canada	BOMA Go Green is the name for BOMA Canada's existing green

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
	http://www.bomagogreen.com/gg.html		building certification system. BOMA took over Green Globes Canada and created BOMA Go Green.
7. Canada LEED	Canadian Green Building Council http://www.cagbc.org/leed/what/index.php	Canada	In 2004, the Canada Green Building Council launched LEED Canada NC version 1 under license from the US Green Building Council. The Canadian Green Building Council has negotiated a new arrangement with the USGBC. Canada's new LEED system will provide a more iterative process, providing assessment at completion of design and construction, as well as a one-year post-occupancy evaluation.
8. CASBEE (Comprehensive Assessment System for Building Environmental Efficiency)	The Japan Sustainable Building Consortium/ The Institute for Building Environment and Energy Conservation (Japan's Green Building Council) http://www.ibec.or.jp/CASBEE/english/index.htm	Japan	CASBEE was developed in Japan, beginning in 2001. The family of assessment tools is based on the building's life cycle: predesign, new construction, existing buildings, and renovation. CASBEE presents a new concept for assessment that distinguishes environmental load from quality of building performance. By relating these two factors, CASBEE results are presented as a measure of (a) eco efficiency or (b) building environmental efficiency..
9. LEED China	U.S. Green Building Council http://www.USGBC.org/	China	Increasingly being utilized by private sector. At year-end 2007, reportedly 5 projects certified and 51 registered.
10. Evaluation Standard for Green Building	Ministry of Construction, Chinese government http://www.unepsbci.org/SBCINews/latestNews/showNews.asp?what=Briefing__Policies_for_Energy_Efficient_Buildings_in_China	China	In June 2006, the MoC released its Evaluation Standard for Green Building, which covered the performance of new buildings, building extensions, and renovations. The "Evaluation Standard for Green Building" (GB/T 50378-2006), is similar to LEED in structure and rating process. The building energy consumption data will be collected by MoC, which will be used to asses building performance, a three-star Green Building certificate will be awarded to the qualified buildings. Green Olympic Building Assessment System
11. China's Green Olympic Building Assessment System (GOBAS)	Chinese government	China	This system was implemented in 2003 to guide the entire planning and development process of the facilities for the 2008 Summer Olympics in Beijing. GOBAS is being evaluated, revised, and turned into a national green building standard. Modeled primarily

Appendix III-D: Measuring Sustainability: Assessment Systems/Tools

System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			on Japan's CASBEE system.
12. BCA Green Mark Scheme	www.bca.gov.sg	Singapore	BCA Green Mark is a green building rating system to evaluate a building for its environmental impact and performance. It is endorsed and supported by the National Environment Agency. It provides a comprehensive framework and points system for assessing building performance and environmental friendliness. Available for new and existing buildings.
13. BEAM	The Beam Society(non-profit) http://www.hk-beam.org.hk/general/home.php	Hong Kong	Beam is a comprehensive voluntary standard and supporting process covering all building types, including mixed use complexes and both new and existing buildings. BEAM is designed to assess, improve, certify and label the environmental performance of buildings.
14. EEWH-9 Indicators	Taiwan Green Building Council, Taiwan Government http://www.taiwangbc.org.tw	Taiwan	EEWH comprises nine indicators that fall into four categories - ecology, energy saving, waste reduction and health - hence the name EEWH. The system was launched in 1999. Green Building approval comes from Minister of the Interior after review of nine indicators by Green Building Committee. There are nine indices for assessing the approval of "Green Building". The nine indicators of Green Building evaluation system are:1) Biodiversity; 2) Greenery; 3) Soil Water Content; 4) Daily Energy Saving; 5) CO_2 Emission Reduction; 6) Waste Reduction; 7) Indoor Environment; 8) Water Resource; and 9) Sewage and Garbage Improvement.
15. Green Star	Australian Green Building Council http://www.gbca.org.au/ http://www.nzgbc.org.nz/	Australia, New Zealand	Green Star is a comprehensive voluntary rating scheme that evaluates environmental design and achievements of buildings. Green Star covers a number of categories that assess the environmental impact that is a direct consequence of a projects site selection, design, construction and maintenance. These categories are divided into credits, each of which addresses an initiative that improves or has the potential to improve environmental performance. Points are awarded in each credit for actions that demonstrate that the project has met the overall objectives of Green

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			Star.
16. BRE Environmental Assessment Method (BREEAM)	Building Research Establishment http://www.breeam.org/	United Kingdom, International	BREEAM has a long track record in the United Kingdom, where it began in 1990. BREEAM covers a range of building types including offices, homes, industrial units, retail units and schools. It is reported that more than 65,000 buildings have received BREEAM certification, with an additional 270,000 buildings that have registered for a BREEAM rating.[32]
17. German Green Building Rating	German Sustainable Building Council http://www.gesbc.org/	Germany	More than 40 members of the construction industry have joined forces to create the German Sustainable Building Council to certify green building projects. Some are under the umbrella of the World Green Building Council. The Council will issue a quality label for owners and users certifying that the buildings comply with the sustainability criteria.
18. LEGEP	http://www.legoe.de/index.php?AktivId=1125	Germany	LEGEP is a tool for integrated life-cycle analysis. It supports the planning teams in the design, construction, quantity surveying and evaluation of new or existing buildings or building products. The LEGEP database contains the description of all elements of a building (based on DIN 276); their life cycle costs (LCC/WLC) based on DIN 18960 and the final report EU-TG4 LCC in Construction. All information is structured along life cycle phases (construction, maintenance, operation (cleaning), refurbishment and demolition. LEGEP establishes the energy needs for heating, warm-water, electricity and their costs (following EnEV 2002 and EN 832). The environmental assessment comprises the material flows (input and waste) as well as an effect oriented evaluation based on ISO 14040 – 43.
19. Eco Effect		Sweden	EcoEffect is a national environmental assessment system focusing on the environmental effects of the use of energy and materials,

[32] Charles Lockwood, "Green Building Standards Around the World," *Urban Land*, June 2007

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			indoor and outdoor environment and life cycle costs.
20. LEED India	http://www.igbc.in/igbc/tests.jsp?event=5518	India	The India Green Building Council released an indigenous LEED rating system that differs from the US standard in several significant ways, primarily by what has been added. First, LEED India incorporates a number of Indian building codes and standards into its criteria, from the National Building Code to the Ministry of Environment and Forest Guidelines. Second, LEED India has greenhouse gas emission and building safety standards. Third, LEED India gives credits to projects that reduce water consumption by 40% or more.
21. SICES	Mexico Green Building Council http://www.mexicogbc.org/mexicogbc/sices_que_e.htm	Mexico	SICES, the Sustainable Building Rating Tool currently being developed by the Mexico GBC, is an evaluation system for buildings, which intends to impulse and accelerates the adoption of sustainable practices in the national building industry through the implementation of standards, rating tools and general criteria with a solid scientific basis. Commercial properties and low-income housing are the first priorities identified.
22. Buildings With Reduced Environmental Impact, 5281	Israel Ministry of Environmental Protection http://www.sviva.gov.il/bin/en.jsp?enPage=e_BlankPage&enDisplay=view&enDispWhat=Zone&enDispWho=israel_green&enZone=israel_green	Israel	This standard is based on a point rating system and together with complementary standards for energy analysis and sustainable products provides a system for evaluating environmental sustainability of buildings. This standard is based on a point rating system (55= certified 75=excellence) and together with complementary standards 5282-1 5282-2 for energy analysis and 1738 for sustainable products provides a system for evaluating environmental sustainability of buildings. United States Green Building Council LEED rating system has been implemented on several buildings and there is movement to introduce an Israeli version of LEED in the very near future.
23. Green Building	Emirates Green Building Council	United Arab	In process of developing a green building rating system based on

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
Rating System	http://www.emiratesgbc.org/tac.htm	Emirates	the best international systems modified appropriately for regional conditions.
24. Dubai City Code	Dubai City http://www.dubaicity.com/news/Green-building-code-in-Dubai-from-next-year-12-08-08.htm		All buildings coming up in Dubai from next year will have to comply with the 'Green' building standards of the Dubai Municipality (DM) failing which the building plans will not be passed, The municipality is preparing a legislative framework, termed 'Green Building Code', for the developers, contractors and consultants to follow. "All building plans coming to us from next year must comply with the code. Right now, we have certain regulations regarding the use of heat insulators in the buildings like insulated floors amid slabs. The Green building standards would have more stipulations," he said.
B. Occupier-Focused Assessments			
1. IPD Environmental Code	IPD, CB Richard Ellis, Bureau Veritas http://www.ipdoccupiers.com/Default.aspx?TabId=1632	International: the IPD operates across 25 countries	The code is a tool for collecting information relating to occupancy and use of corporate buildings. It can be implemented across many property types and is designed to address the leadership challenges around effective environmental performance measurement. The goal is to answer the key question "How does my performance compare against other key organizations?"
2. Leased Space Leadership Consortium	Various corporate real estate executives	International	Group of some of the largest corporate real estate owners in the world that have put together a set of minimum criteria for consideration by the major corporations leasing space around the world. These criteria are meant to assist owners and developers in increasing the supply of sustainable space to lease around the world and set a lower target than LEED or most other green rating systems. However, they do have a strong energy focus, with separate energy meters being key minimum criteria.

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
3. Global Green Rating System	Bureau Veritas	European, International	The GGR, being developed by a group of large investment managers, is intended to assess and benchmark the environmental performance of existing buildings by a number of measurable indicators including energy and water consumption, waste production, carbon emissions, transportation, and occupier health and safety. The rating will be assessed on site by a third party. A key aspect of the rating is to provide building benchmarks to monitor ongoing improvements
4. ASHRAE's Building Energy Labeling Program	ASHRAE	International	The objective of ASHRAE's building labeling effort is to provide motivation for reducing energy use in commercial buildings by expressing the energy performance of buildings in a tangible way. Commercial buildings are defined as those buildings covered by the scope of ASHRAE/IESNA Standard 90.1.
5. Global Reporting Initiative	Global Reporting Initiative http://www.globalreporting.org/Home	International	The Global Reporting Initiative (GRI) is a large multi-stakeholder network of thousands of experts, in dozens of countries worldwide, who participate in GRI's working groups and governance bodies**.** The Global Reporting Initiative (GRI) has pioneered the development of the world's most widely used sustainability-reporting framework and is committed to its continuous improvement and application worldwide. This framework sets out the principles and indicators that organizations can use to measure and report their economic, environmental, and social performance.
6. Carbon Disclosure Project	Carbon Disclosure Project http://www.cdproject.net/	International	Signatories to the Carbon Disclosure Project include over $57 trillion (8/08) worth of institutional investment assets. These signatories, through the Carbon Disclosure Project, sponsor a questionnaire and disclosure of carbon usage by major corporations in the world. Over 3,000 major corporations responded in CDP in 2008.
7. Corporate Social Responsibility Reports	Individual corporations http://www4.globalcompliance.com/corporate-social-responsibility-reports.html	International	Corporate Social Responsibility Reports are put out, similar to annual reports, to provide an overall assessment of a corporation's activities in the corporate social responsibility area.

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
8. Analyst and Investor Monitoring	Varies http://www.innovestgroup.com/ http://www.trucost.net/	International	Firms like True Cost, Innovest, Goldman Sachs and others have created detailed assessments of corporate equities and other investments, analyzing and evaluating their sustainability, including an increasing focus on real estate. These initiatives are gaining strength and volume, and will continue to be important.
C. Government Regulations/Assessment Systems			
1. Federal, State, Local Regulations/Incentives	Database of State and Local Incentives http://www.dsireusa.org/Index.cfm?RE=0&EE=1 ICLEI: Local Governments for Sustainability http://www.iclei.org/index.php?id=global-about-iclei Institutional Efforts for Green Building, Alex Wilson http://www.greenbuildingfc.com/Home/DocumentDetails.aspx?id=1066	International	There are thousands of regulations, incentives, guidelines, building codes, etc. throughout the USA and the world. There are 44,000 municipal governments in the USA alone. I have added a few interesting links that outline the kinds of regulations and incentives being promulgated.
2. The Federal Green Construction Guide for Specifiers	U.S. Government Whole Building Design Guide http://fedgreenspecs.wbdg.org/	USA	A comprehensive guide for procuring green building products and construction services within the Federal government. EPA partnered with the Federal Environmental Executive and the Whole Building Design Guide (WBDG) to develop.
3. Strengthening Federal Environmental, Energy and Transportation Management, Executive Order 13423, January 24, 2007	U.S. Government http://ofee.gov/sb/sbusp	USA	Requires substantial majority of Federal agencies to implement sustainable and energy efficiency principles in their use of buildings.
4. European Energy	European Commission, Energy Performance of	Europe	This directive has been in effect since January 4, 2006. All EU

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
Performance of Buildings Directive (EPBD)	Buildings, Directive 2002/91/EC of the European Parliament and of the Council; Official Journal of the European Communities, Brussels http://www.buildingsplatform.org/cms/		member states, with a few minor exceptions, are obligated to bring into force national laws, regulations, and administrative provisions for setting minimum requirements on the energy performance of new and existing buildings that are subject to major renovations and for energy performance certification of buildings.
5. California AB 32	State of California, USA http://www.arb.ca.gov/cc/cc.htm	California, USA	California's major initiatives for reducing climate change or greenhouse gas (GHG) emissions are outlined in Assembly Bill 32 (signed into law 2006), 2005 Executive Order and a 2004 ARB regulation to reduce passenger car GHG emissions. These efforts aim at reducing GHG emissions to 1990 levels by 2020 - a reduction of about 25 percent, and then an 80 percent reduction below 1990 levels by 2050. The main strategies for making these reductions are outlined in the Scoping Plan. Also provided here are links to state agencies and other groups working on climate issues, which are being coordinated by the state's Climate Action Team.
6. The Restriction of Hazardous Substances (RoHS) Directive	The European Union, July 2006 http://www.rohs.gov.uk/	Europe	RoHS traces its beginning back to 2003. This directive reduces the permitted amounts of 6 hazardous materials in the manufacture of various types of electronic and electrical equipment. (The RoHS Directive, The Construction Specifier, John Melchin, November 2007)
7. Sustainable Project Rating Tool (SPIRIT)	United States Army http://www.erdc.usace.army.mil/pls/erdcpub/!www_fact_sheet.PRODUCT_PAGE?ps_product_numb=50032&tmp_Main_Topic=&page=All	USA, International	This listing provides an example of the many approaches different agencies have taken to implement sustainable practices. The SPIRIT criteria are very similar and based upon LEED criteria. (Army green, Not Just For Camouflage Anymore, John Miller, www.edcmag.com, 2007) The Army is now transitioning from SPIRIT to LEED. While the standards of LEED will need to be met for all military facilities, certification will not be required.
D. Other Building Performance Assessments/Standards			
1. SBTools 07	The International Initiative For a Sustainable Built Environment (iiSBE) http://www.iisbe.org/iisbe/start/iisbe.htm/	International	SBT 07 is an assessment checklist that provides a means to assess building performance and is tied into regional climate zones, local building codes, and international standards. SBT07 provides a

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			generic toolkit for any local organization to use to develop a rating system. The system establishes a weighting system for regional parameters such as climate and occupancy. The tool provides a result analysis, which indicates the relative and absolute performance of the project as acceptable, good, or best practice. Used to be called GB Tool.
2. Energy Star Label	Environmental Protection Agency (EPA) http://www.energystar.gov/	United States	Energy Star's Portfolio Manager benchmarking tool allows building owners to compare their buildings' energy efficiency to a peer group of buildings. Buildings receiving an Energy Performance Rating of 75 or greater (75th percentile or higher) and satisfying certain other prerequisites can earn the EnergyStar label.
3. eco Energy Retrofit	Natural Resource Canada, Office of Energy Efficiency	Canada	Incentive program that defines a process for certifying predicted energy performance of large buildings. Formerly CBIP (Canadian Commercial Building Incentive Program).
4. ISO/TS 21929-1:2006 Sustainability in Building Construction—Sustainability Indicators—Part I: Framework for Development of Indicators for Buildings	International Organization for Standardization http://www.iso.org/iso/catalogue_detail?csnumber=40436	International	This provides a framework, makes recommendations, and gives guidelines for the development and selection of appropriate sustainability indicators for buildings.
5. ISO 15392:2008: Sustainability in Building Construction—General Principles	The International Organization for Standardization www.iso.org/iso/home.htm/	International	Identifies and establishes general principles for sustainability in building construction. It is based on the concept of sustainable development as it applies to the lifecycle of buildings and other construction works, from their inception to the end of life. However, this standard does not provide levels (benchmarks) that can serve as the basis for sustainability claims. It is not intended to provide the basis for assessment of organizations or stakeholders,

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System / Tool	Sponsor / Web Address	Primary Country / Region	Primary Purpose / Miscellaneous Comments
			but is more applicable to buildings and the materials, products, surfaces, and processes that are involved in construction.
6. ISO/TS 21931-1:2006 Sustainability in Building Construction—Framework for Methods of Assessment for Environmental Performance of Construction Works—Part I Buildings	The International Organization for Standardization http://www.iso.org/iso/home.htm	International	This standard provides a general framework for improving the quality and comparability of methods for assessing the environmental performance of buildings. It identifies and describes issues to be taken into account when using methods for the assessment of environmental performance for new or existing building properties in the design, construction, operation, refurbishment and deconstruction stages. It is to be used in conjunction with, and following the principles set out in the ISO 14000 series of international standards.
7. The ATHENA Eco-calculator for Assemblies	Green Building Initiative (Green Globes), Athena Institute http://www.athenasmi.org/tools/ecoCalculator/index.html	Applicable International/USA	The calculator uses expertise and data from the ATHENA Institute's Impact Estimator for Buildings and the US Lifecycle Inventory Database to project the building's climate change impact. It can be used for many building projects ranging from new construction to industrial, residential, office and institutional designs.
8. ASTM E2114-06 Standard Terminology for Sustainability Relative to the Performance of Buildings	ASTM International http://www.astm.org/Standards/E2114.htm	International	This terminology consists of terms and definitions pertaining to sustainable development; and, in particular to sustainability relative to the performance of buildings. The purpose of this terminology is to provide meanings and explanations of terms applicable to sustainable development. In the interest of common understanding and standardization, consistent word usage is encouraged to help eliminate the major barrier to effective technical communication.

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9. ASTM WK11944: New Specification for Minimum Attributes of a Building that Promotes Sustainability	ASTM International http://www.astm.org/DATABASE.CART/WORKITEMS/WK11944.htm		This specification sets forth minimum attributes and reporting requirements of a building that promotes sustainability. The attributes are consistent with the principles described in E2432. Additionally, the attributes are consistent with the Guiding Principles set forth in the "Federal Leadership in High Performance and Sustainable Buildings Memorandum of Understanding" (2006) and mandated for U.S. federal agency buildings per Executive Order 13423 "Strengthening Federal Environmental, Energy, and Transportation Management
10. ASTM Committee E06 on Performance of Buildings	ASTM International http://www.astm.org/COMMIT/COMMITTEE/E06.htm	International	ASTM Committee E06 was formed in 1946. The committee, with a membership of 1,050, has jurisdiction of over 245 standards, published in The Annual Book of ASTM Standards, vol. 04.11 and 04.12. The E06 has 18 technical subcommittees that maintain jurisdiction over these standards. These standards have played and continue to play a pre-eminent role in the building industry and address issues relating to the performance of buildings, their elements, components, and the description, measurement, prediction, improvement and management of the overall performance of buildings and building-related facilities.
11. IECC	International Energy Conservation Code **2006**	International	Encourages energy conservation through efficiency in envelope design, mechanical systems, lighting systems and the use of new materials and techniques.
12. Multi-Family Green Building Guidelines, July 2004	Alameda County Waste Management Authority http://www.multifamilygreen.org	Alameda County; broadly applicable	This publication offers detailed, cost effective recommendations for reducing construction related waste, creating healthier and more durable homes, reducing costs for building owners, and supporting local suppliers of resource efficient building materials.
13. The Green Guide for Rehabilitation, 2008	Bay Area LISC, Build It Green http://www.bayarealisc.org/bay_area/resources/publications_8392/green_10365/index.shtml	San Francisco Bay Area; broadly applicable	This guide is an accessible tool to help affordable housing owners and their consultants integrate green building and energy efficiency into the upgrades of their multi-family properties. 58-page guide contains sections on site condition and system, building construction, mechanical systems and interior spaces. This also

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			offers green operations and maintenance toolkit and buyer's guide.
E. Product/Material Assessments/Certifications			
1. BEES (Building for Environmental and Economic Sustainability)	NIST (National Institute of Standards and Technology) http://www.bfrl.nist.gov/oae/software/bees/		BEES provides software that enables selecting cost-effective, environmentally preferred building products. BEES was developed by the National Institute of Standards and Technology's building and fire research laboratory. The tool is based on consensus standards and designed to be practical, flexible and transparent.
2. Construction Specifications Institute (CSI) Green Format	Construction Specifications Institute http://www.greenformat.com/	USA/International	The new CSI Green Format provides a consistent framework for reporting and analyzing information that is responsive to sustainability requirements by work categories. The advantage of the structured format consistent with the standard format used to prepare project specifications is important. The format is applicable to products, materials, assemblies and systems to help the project team make selections that meet varying requirements of different performance measurement systems such as LEED.
3. Oikos Green Product Information	Iris Communications, Inc. http://www.oikos.com/green_products/index.php	USA	Oikos is a searchable product database.
4. GreenSpec Product Database	BuildiingGreen.com http://www.buildinggreen.com/menus/index.cfm	USA	The online GreenSpec® Directory lists product descriptions for over 2,000 environmentally preferable products. To choose these products Building Green editors conduct their own research based on GreenSpec's current editorial focus. Thus not all product suggestions we receive are selected for review. This independent research helps to obtain unbiased, quality information. They do not charge for listings or sell ads.
5. iGreenBuild Green Buyers Guide	iGreenBuild http://www.igreenbuild.com/_coreModules/common/categoryDetail.aspx?categoryID=0&entityType=7	USA	Searchable database of products and services.
6. BRE Green Guide to Specification	Building Research Establishment (BRE) http://www.bre.co.uk/greenguide/page.jsp?sid=435	United Kingdom	The Green Guide to Specification is an easy-to-use publication, providing guidance for specifiers, designers and their clients on the relative environmental impacts of over 250 elemental specifications

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			including roofs, walls and floors.
7. BRE Sustainability Checklist for Development	Building Research Establishment (BRE) http://www.brebookshop.com/details.jsp?id=139452	United Kingdom	This checklist provides practical tools and indicators to measure the sustainability of developments (buildings and infrastructure) at the site or estate level.
8. Ecospecifier	Various http://www.ecospecifier.org	Australia	A Guide to sourcing environmentally preferable materials promoted by various Institutes for protection of the environment. Australia.
9. Green Products Guide	Architectural Record http://www.archrecord.com/GREEN/GREEN.ASP	USA	Database that provides specifications for green building products and materials, as well as links to manufacturers' sites, proposed by Architectural Record.
10. Healthy and Sustainable Building Materials Database	HOK - Hellmuth, Obata + Kassabaum.	International	Database to facilitate accessibility to information on the environmental and health impacts of building materials throughout their life cycle.
11. Recycled-Content Product Database	State of California Integrated Waste Management Board	USA	Database that allows the search for products by product, company, category, or by specifying minimum recycled and post-consumer content.
12. Recycled Products List	ADME, France http://www.produits-recycles.com/	France	List proposed by ADEME, France. (only French language)
13. Sustainable Architecture, Building and Culture Compendium	SustainableABC.com http://www.sustainableabc.com/	International	A good compendium of links and content oriented to the global community of ecological and natural building components.
14. The Sustainable Design and Construction Database	National Park Service http://www.nps.gov/dsc/dsgncnstr/susdb/	USA	Database that has approximately 1300 product listings from over 550 manufacturers, listings of over 7000 recyclers of construction debris nation-wide, and expanded listings of books, periodicals, organizations, and on-line (Internet) sources of sustainable information.
15. Canada ENERguide	Natural Resources Canada www.fnnboa.ca/documents/NRCan_Presentation.ppt	Canada	ENERguide is an energy labeling program developed by Natural Resources Canada (NRCan) to communicate to consumers the impact their purchasing decisions have on energy consumption.

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			This labeling program applies primarily to products and single-family homes.
16. ASTM E2129-05 Standard Practice for Data Collection for Sustainability Assessment of Building Products	ASTM International http://www.astm.org/Standards/E2129.htm	International	This practice covers a set of instructions for collecting data to be used in assessing the sustainability of building products for use in both commercial and residential buildings.
17. ASTM Environmentally Preferred Products	ASTM International	International	This standard establishes a classification of environmental aspects of building products. 1.2 This classification can be used to estimate the level of environmental performance of an existing building product. It can also be used to estimate the environmental performance of a building product that is planned but not yet in production.
18. International Organization for Standardization (ISO) 21930:2007	International Organization for Standardization http://www.iso.org/iso/home.htm	International	This new standard is aimed at sustainable buildings and focuses on environmental declarations of building products taking into consideration the entire life cycle of a building. This standard describes the principles and framework for environmental declaration of building products. The standard will establish uniformity and consistency in the way environmental product declarations are made. The goal of the declaration is to encourage the demand for, and supply of, building products that cause less stress on the environment.
19. Sustainable Sites Initiative, Rating System for Sustainable Landscape Design	The American Society of Landscape Architects (ASLA) http://www.sustainablesites.org	USA	This rating system for sustainable landscape is similar to LEED. It is intended to be adopted into the US Green Building Council's LEED system.
20. United States Executive Order 13423	US Office of the Federal Executive http://www.wbdg.org/sustainableEO/index.php	USA	The technical guidance includes clarification of requirements, related mandates, additional recommendations and considerations; and resources for implementation, including model contract and specification language per the Federal Green Construction Guide

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			for Specifiers. See also Green Purchasing at http://ofee.gov/gp/gp.asp.
21. BIFMA Furniture Emissions Standard	The Business and Institutional Furniture Manufacturer's Association http://www.bifma.org/standards/index.html	International	Evaluates the sustainable attributes of furniture products. It addresses all three aspects of sustainability (environmental, economic and social) and includes criteria for evaluating human & ecosystem health, energy, natural resource and corporate social responsibility impacts.
22. Carpet & Rug Institute's Green Label Plus	Carpet and Rug Institute: 800-882-8846 http://www.carpet-rug.org/drill_down_2.cfm?page=8&sub=4	International	A program to test carpet, cushions and adhesives to help specifiers identify products with very low emissions of VOCs. Green Label Plus ensures that customers are purchasing the very lowest emitting products on the market. Relevant to LEED v2.2
23. Climate Cool Certification	Climate Neutral Network http://climateneutralnetwork.org/standards.php	International	Climate Cool certified products, services, and enterprises are those that reduce or offset the greenhouse gas emissions with which they are associated to achieve a net zero impact on the earth's climate.
24. Environmental Technology Verification by EPA	Environnemental Protection Agency http://www.epa.gov/etv/	USA	Protocols that verify the performance of innovative environmental technologies that have the potential to improve protection of human health and the environment. Goal is to provide credible performance data for commercial-ready environmental technologies to speed their implementation.
25. Forest Stewardship Certification	Forest Stewardship Council http://www.fsc.org	International	Products carrying the FSC label are independently certified to assure consumers that they come from forests that are managed to meet the social, economic and ecological needs of present and future generations. Relevant to LEED v2.2
26. Green Seal Standard	Green Seal http://www.greenseal.org	International	Green Seal works with manufacturers, industry sectors, purchasing groups, and governments to "green" the production and purchasing chain. They evaluate a product or service beginning with material extraction, continuing with manufacturing and use, and ending with recycling and disposal. Products become Green Seal certified after rigorous testing and evaluation, including on-site plant visits. Relevant to LEED v2.2
27. GreenGuard Certification	GreenGuard Environnemental Institute http://www.greenguard.org	International	1) Product certification program for low emitting interior building materials, furnishings, and finish systems; 2) product certification

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Programs			program for low emitting interior building materials, furnishings, and finish systems used in educational, office and other sensitive environments; and 3) building certification program for newly constructed multifamily and commercial properties that follow best practice guidelines for preventing mold during the design, construction and ongoing operations.
28. MBDC's Cradle to Cradle	MBDC http://www.mbdc.com	International	Consulting firm that works with business and industry clients to establish a "positive design paradigm" (i.e. ecologically sound).
29. SCS Biodegradability Certification	Scientific Certification Systems http://www.scscertified.com/manufacturing/manufacture_biocertstand.html	International	SCS Biodegradability Certification standards are designed to verify that products degrade safely and efficiently, even under worst-case circumstances, and that they do not build up to harmful concentrations in the environment.
30. SCS Environmentally Preferable Products	Scientific Certification Systems http://www.scscertified.com/epp/index.html	International	SCS offers a certification program for Environmentally Preferable Products (EPP) to address the growing demand for products and services that have the least impact on the environment. Program development follows Executive Order 13101, which directs federal agencies and their contractors to identify and purchase products designated as "environmentally preferable."
31. SCS and RFCI Floor Score	Scientific Certification Systems and Resilient Floor Covering Institute http://www.rfci.com/	International	The FloorScore program, developed by the Resilient Floor Covering Institute in conjunction with Scientific Certification Systems, tests and certifies flooring products for compliance with indoor air quality emission requirements adopted in California.
32. SCS Indoor Advantage	Scientific Certification Systems http://www.scscertified.com/ecoproducts/indoorairquality/index.html	International	Offers four indoor air quality certification programs: Indoor Advantage, Indoor Advantage Gold, FloorScore, and No Added Formaldehyde.
33. SCS Material Content Certification	Scientific Certification Systems http://www.scscertified.com/ecoproducts/materialcontent/index.html	International	Through their Material Content certification programs, manufacturers earn the right to label products with SCS third-party certification, verifying claims including recycled, reclaimed, salvaged, and bio-based materials content.

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34. SCS Sustainable Choice	Scientific Certification Systems http://www.scscertified.com/ecoproducts/sustainablehoice/index.html	International	A multi-attribute certification label for products that have met environmental, social and quality standards. Currently available for business and institutional furniture and carpet.
35. The Smart Building Product Standard	Institute for the Market Transformation to Sustainability http://MTS.sustainableproducts.com	International	The Standard is almost identical to the approved Smart©Fabric flooring and apparel standards and California Gold sustainable carpet standard adopted by the State for all purchasing.
36. The GreenSage Guide to Green Materials	Green Sage http://www.GreenSage.com	International	Sustainable furnishings and materials. This green product directory began in 1998.
37. Autodesk Sustainable Materials Assistant	Autodesk http://labs.autodesk.com/technologies/sustainable_materials_assistant/	International	The Sustainable Materials Assistant was created to help designers make greener decisions by paying attention to materials choices, including toxic, hazardous or recyclable materials; determines the carbon footprint of projects.
38. ADA Advanced Buildings Benchmark v1.1	The U.S. Americans with Disabilities Act of 1990	USA	Relevant to LEED v2.2
39. ASHRAE 52.2-1999	ASHRAE Standard Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size. http://www.techstreet.com/standards/ASHRAE/52_2_1999?product_id=229518	USA	Relevant to LEED v2.2
40. ASHRAE 55-2004	ASHRAE Standard Thermal Environmental Conditions For Human Occupancy. http://escholarship.org/uc/item/2m34683k	USA	Relevant to LEED v2.2
41. ASHRAE 62.1-2004	ASHRAE Standard Ventilation for Acceptable Indoor Air Quality. Paragraph 5.1 http://www.realread.com/prst/pageview/browse.cgi?book=1931862672	USA	relevant to LEED v2.2

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42. ASHRAE 90.1-2004	ASHRAE Energy Standard for Buildings Except Low-Rise Residential Buildings. http://www.realread.com/prst/pageview/browse.cgi?book=1931862664	USA	Relevant to LEED v2.2
43. ASTM E1903-97(2002)	Standard Guide for Environmental Site Assessments: Phase II Environmental Site Assessment Process. Brownfield Redevelopment. http://www.astm.org/Standards/E1903.htm	USA	Relevant to LEED v2.2
44. ASTM E1980-01	Standard Practice for Calculating Solar Reflective Index of Horizontal and Low-Sloped Opaque Surfaces. http://webstore.ansi.org/RecordDetail.aspx?sku=ASTM%20E1980-01	USA	Relevant to LEED v2.2
45. ASTM E779-03	American National Standards Institute http://webstore.ansi.org/RecordDetail.aspx?sku=ASTM%20E779-03	USA	Standard Test Method for Determining Air Leakage Rate by Fan Pressurization. Relevant to LEED v2.2 http://webstore.ansi.org/RecordDetail.aspx?sku=ASTM%20E779-03
46. CISBE AM10	Chartered Institution of Building Services Engineers (CIBSE). Natural Ventilation in Non-Domestic Buildings. Applications Manual 10: 2005 http://www.cibse.org/index.cfm?go=publications.view&PubID=297&S1=y&L1=0&L2=0	USA	Relevant to LEED v2.2
47. CRS Green-e Products Certification Reqs.	Center for Resource Solutions (CRS)	USA	Relevant to LEED v2.2
48. EPA 600/S4-90-010, May 1990	EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air	USA	Relevant to LEED v2.2
49. IESNA: Recommended Practice Manual: Lighting for Exterior Environments	Illuminating Engineering Society of North America http://www.iesna.org/	North America	Relevant to LEED v2.2

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50. IPMVP (International Performance Measurement and Verification Protocol)	International Performance Measurement and Verification Protocol Volume III: Concepts and Options for Determining Energy Savings in New Construction (April, 2003) http://www.evo-world.org/index.php?option=com_content&task=view&id=61&Itemid=80	International	Relevant to LEED v2.2
51. ISO 14021	Environmental Labels and Declarations: Self-Declared Environmental Claims (Type II Environmental Labeling)	International	Relevant to LEED v2.2
52. NAAQS	National Ambient Air Quality Standards	USA	Standards established by the EPA that apply to outdoor air throughout the country.
53. NPDES	EPA National Pollutant Discharge Elimination System (NPDES) Program, Phase I and II	USA	Relevant to LEED v2.2
54. Title 24	California Building Standards Commission (CBSC).	California	One of 26 titles of the California Code of Regulations.
F. Service Provider Assessments/Certifications/Directories			
1. High Performance Building Design Professional Certification	ASHRAE http://www.ashrae.org/certification/page/1683	North America	ASHRAE has developed the HBDP program in close collaboration with the Illuminating Engineering Society of North America (IESNA) and the Mechanical Contractors Association of America (MCAA) and with input from the U.S. Green Building Council (USGBC) and the Green Building Initiative (GBI). Candidates who earn the HBDP certification will have demonstrated a well-rounded understanding and knowledge of how HVAC&R design is integrated into high performing buildings to achieve the overall goal of producing a sustainable HVAC&R design.
2. GreenSage Directory of Green Commercial Property Experts	GreenSage http://www.greensage.com/experts.php?MarketID=2&AreaID=5	USA	Directory of "Experts". No apparent requirement or screening of service providers listed.
3. LEED Accredited Professionals	USGBC—The Green Building Certification now manages the accreditation process. http://www.gbci.org/	USA	LEED Accredited Professionals (LEED APs) are building industry professionals who have demonstrated a thorough understanding of green building and the LEED® Green Building Rating System™.

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			http://www.usgbc.org/DisplayPage.aspx?CMSPageID=222 The LEED AP credential indicates that the professional has the knowledge and skills to facilitate the LEED certification process. http://www.usgbc.org/DisplayPage.aspx?CMSPageID=64
4. AIA Architect Finder	http://architectfinder.aia.org/	USA	AIA provides a searching function to find specialists and includes LEED Certification, Sustainable Design and other search choices to assist in finding sustainability specialists.
5. ASLA Sustainable Design and Development Practice Network	American Society of Landscape Architects http://host.asla.org/groups/sddpigroup/	USA	Network of landscape architects committed to sustainable design.
6. NAHB Certified Green Professional	National Association of Homebuilders http://www.nahb.org/category.aspx?sectionID=1174	USA	The National Association of Home Builders' Certified Green Professional™ designation recognizes builders, remodelers and other industry professionals who incorporate green building principles into homes— without driving up the cost of construction. Classwork leading to the designation provides a solid background in green building methods, as well as the tools to reach consumers, from the organization leading the charge to provide market-driven green building solutions to the home building industry.
7. Inspector of Green Building Technologies	International Code Council	International	The International Code Council is developing an Inspector of Green Building Technologies certification exam to demonstrate a code official's ability to understand the application of green building technology and assess adherence with green building programs. The new certification will help provide assurances that green and sustainable buildings also are safe.
8. Built Green™ Products Catalogue	Built Green™ Society of Canada. http://www.builtgreencanada.ca/content.php?id=279	Canada	Homebuilder focus. Only products and services that have been accepted by the Built Green™ Society of Canada are listed. The Catalogue has been updated to mirror the current Built Green™ Checklist to reflect a greater focus on helping builders fulfill these requirements. Checklist line items that currently have products

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			available are detailed. A comprehensive application form with accompanying documentation is required in order for the Built Green™ Society to review and approve these products and services.
9. NAR Green Designation	National Association of Realtors http://www.greenresourcecouncil.org/mission.html	USA	Provides real estate professionals with the knowledge and awareness of green building principles applied in residences, commercial properties, developments, and communities so that they can list, market, and manage green properties as well as guide buyer-clients, in purchasing green homes and buildings
10. Certified Commissioning Professional (CCP)	Building Commissioning Association http://www.bcxa.org/certification/index.htm	USA	The CCP™ designation was created to raise professional standards and provide a vehicle for certification in the building commissioning industry. To be eligible, you must have at least 36 continuous months of experience as a commissioning-services provider in a lead project role (within 5 years preceding the date of application) and satisfy the requirements for experience as outlined in the Candidate Bulletin. http://www.bcxa.org/certification/bulletin.htm The candidate must then be approved by the BCA.

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