

Measuring Sustainability for Existing Buildings

Louise Sabol

IFMA World Workplace, November 2008.

Contents

- Overview
- LEED Green Rating System
- Other Sustainability Metrics
- Technologies Supporting Sustainable Facilities
- Appendix A: Glossary of Terms
- Appendix B: References

Abstract

Sustainability is an increasingly important topic within the business world and in facilities management, driving the re-thinking of many traditional practices. Improving an organization's contribution to sustainability involves increasing the life span on human systems, such as the built environment, while reducing their impact on the natural environment. Sustainable practices aim to improve the stewardship of our resources for the future - a goal consistent with effective facility management.

Overview

Sustainability is an increasingly important topic within the business world and in facilities management, driving the re-thinking of many traditional practices. Improving an organization's contribution to sustainability involves increasing the life span on human systems, such as the built environment, while reducing their impact on the natural environment. Sustainable practices aim is to improve the stewardship of our resources for the future - a goal consistent with effective facility management.

Environmental Impacts of Buildings

Buildings significantly and often negatively impact the environment and consumption of natural resources. Building operation accounts for 40% of U.S. energy use¹; this number increases to an estimated 48% when energy required to make building materials and construct new buildings is included. Building operations also contribute over 38% of the U.S.'s carbon dioxide emissions and over 12% of its water consumption. Furthermore waste from demolition, construction and remodeling makes up over 35% of all non-industrial waste.² Construction and remodeling of buildings account for 3 billion tons or 40% of raw material use globally each year.³ Direct and indirect material investments in the built environment account for 70% of all national physical flows⁴.

¹ Annual Energy Review 2005. DOE/EIA-0384 (2005). Energy Information Administration, U.S. Department of Energy. July 2006.

² Characterization of Building-Related Construction and Demolition Debris in the United States. Office of Solid Waste, U.S. Environmental Protection Agency. July 1998. <http://www.epa.gov/epaoswer/hazwaste/sqg/c&d-rpt.pdf>, 18 December 2006.

³ Lenssen and Roodman, 1995, "Worldwatch Paper 124: A Building Revolution: How Ecology and Health Concerns are Transforming Construction," Worldwatch Institute.

⁴ Matos, G.R., and Wagner. "Consumption of materials in the United States, 1900–1995." Annual Review of Energy and the Environment 1998, v. 23, p. 107–122.

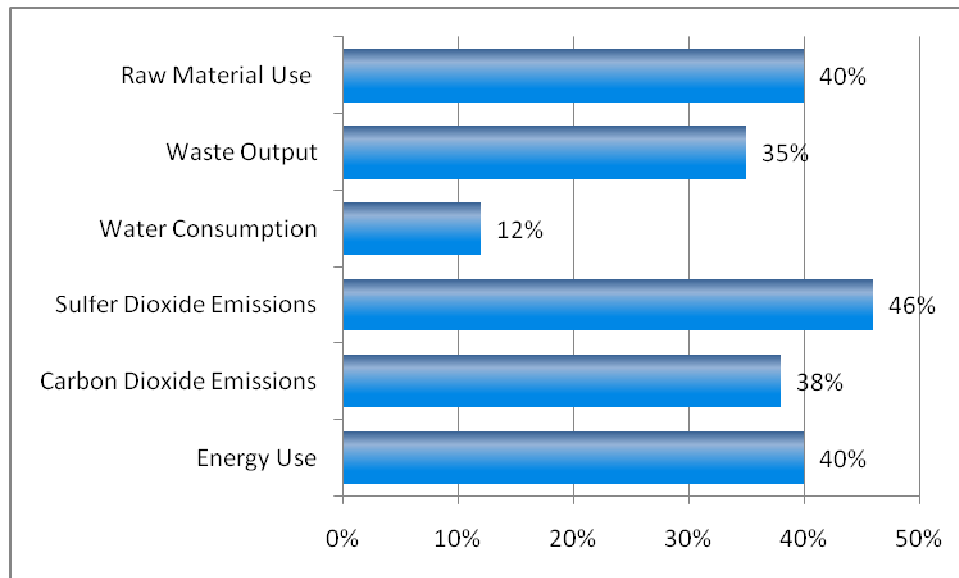


Figure 1: Environmental Impact of U.S. Building, Percentage Annual Impact⁵

Energy is the largest operational expense for most facilities, contributing to at least 30% of a typical office building's expenses. The U.S. Green Building Council estimates that commercial office buildings use 20% more energy on average than necessary. Therefore it is evident that these facilities are wasting natural resources, which is both detrimental to the environment and also an increased cost to corporations. As a result many organizations are beginning to undertake sustainable measures in order to decrease these energy costs. This recent increased support for sustainability has caused the green building industry to expand rapidly, from \$12 billion in revenues in 2007 to more than \$42 billion estimated by 2015.⁶

LEED Green Rating System

Although there is no single standard for measuring sustainability in the U.S, the Leadership in Energy and Environmental Design (LEED) green building rating system, developed by the U.S. Green Building Council (USGBC), is becoming the de facto standard. As a voluntary rating system first introduced in 1999, LEED has since developed multiple rating systems for various construction types. Most notably for facilities managers is LEED-EB, a certification framework aimed at existing buildings.

LEED-EB, in practice since 2004, shares many of the same sustainable goals as LEED-NC (new construction), however focuses its attention towards the operation phases of a building's life cycle. LEED-EB's primary goal is to maintain and possibly improve a building's sustainability throughout its life.

⁵ Green Building Research Funding: An Assessment of Current Activity in the United States. Mara Baum, U.S. Green Building Council, 2007. <http://www.usgbc.org/ShowFile.aspx?DocumentID=2465>

⁶ "LEED and Beyond: Evolving Trends in North America." Frost & Sullivan. 6 March 2008.

LEED-EB is applicable to any of the 4.6 million existing buildings in the United States, including those that have already been LEED-NC certified. In fact, LEED-NC buildings are a natural fit to be LEED-EB-certified because LEED-EB becomes the vehicle by which a building that has been designed green can be kept green throughout its lifecycle. If a building is not already LEED-NC-certified, a prerequisite credit of LEED-EB mandates that a building must be at least two years old to be eligible for certification.

The LEED-EB rating system evaluates a building in five areas: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, and Indoor Environmental Quality. A project is rated on each of the five areas which determine the level of certification the building will be awarded. The four progressive levels of certification are Certified, Silver, Gold and Platinum. LEED-EB requires recertification at a frequency designated by the facilities team, at least every five years and at most every year, with the intent of keeping facility practices to stay the green course.



LEED-EB Operations & Maintenance

Point Distribution

SS: Sustainable Sites
 WE: Water Efficiency
 EA: Energy & Atmosphere
 MR: Materials & Resources
 EQ: Indoor Air Quality
 IO: Innovation in Operation

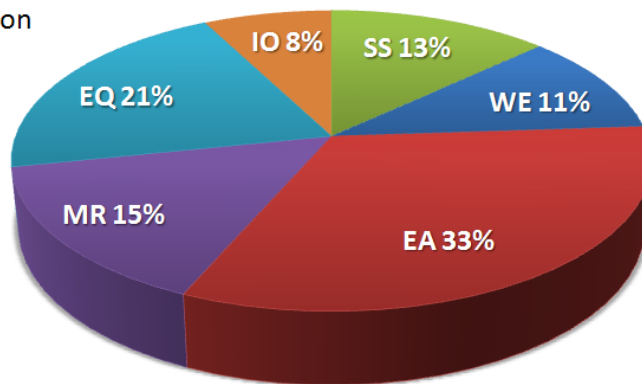


Figure 2: USGBC LEED-EB O&M Point Distribution for Credit Categories

For LEED-EB, the credits are designed to help a facility operate efficiently and sustainably after its opening and into its future. LEED-EB credits generally don't specify a single green technology but instead require plans to maintain sustainable initiatives. In fact, several LEED-EB credits require the facility team to formulate plans, collect data to illustrate the performance of the plans and document that the plans are successful.

LEED is an evolving standard especially for the existing buildings (EB) certification. In 2008, it was renamed *LEED EB v2008 - Operations and Maintenance* and put on a yearly upgrade cycle to accommodate the developing nature of the discipline. As a result, a greater focus has been placed on operations and maintenance as well as performance and best practices.

Economics of LEED-EB

The Leonardo Academy produces an annual white paper on the economics of LEED-EB, based on survey information by owners of LEED-EB certified buildings.⁷ This is one example of information, becoming increasingly available, that illustrates the benefits of achieving LEED certification. Their study compares average building operating costs per square foot vs. BOMA data. Some notable statistics are listed below:

- Total expenses per square foot of the LEED-EB buildings are less than the BOMA average for 7 of the 11 buildings (64%).
- The overall cost of LEED-EB implementation and certification ranges from \$0.00 to \$6.46 per square foot of floor space, with an average of \$2.43 per square foot.
- Cost of implementing the LEED-EB prerequisites found to be “low cost or no cost” by more than 80% of the survey respondents.
- Total expenses per square foot of the LEED-EB buildings are usually less than the BOMA average for the region.

Executing LEED-EB

To assist in executing LEED-EB, the USGBC LEED-EB website provides guidance on how to prepare an organization. It advises that the sustainability efforts must be aligned with the goals of the organization. The first step of this process should be to establish corporate approval for the effort. Once approval has been secured, the staff responsible for executing certification and implementing policies and practices on a daily basis must be informed.

Before commencing such an effort, conduct a comprehensive sustainability audit to survey how a building is operated and managed, reviewing such wide-ranging items as:

- What is the indoor air quality?
- Has the building been commissioned?
- What chemicals come in and out of the facility?
- What are the utility costs?

The next step is to compare the existing conditions of the facility against the requirements put forth by LEED-EB, and then document improvements that should be implemented in order to meet LEED-EB standards.

⁷ “The Economics of LEED for Existing Buildings for Individual Buildings. A White Paper”. Leonardo Academy, Inc. April 21, 2008. <http://www.leonardoacademy.org/Resources/reports/index.htm>

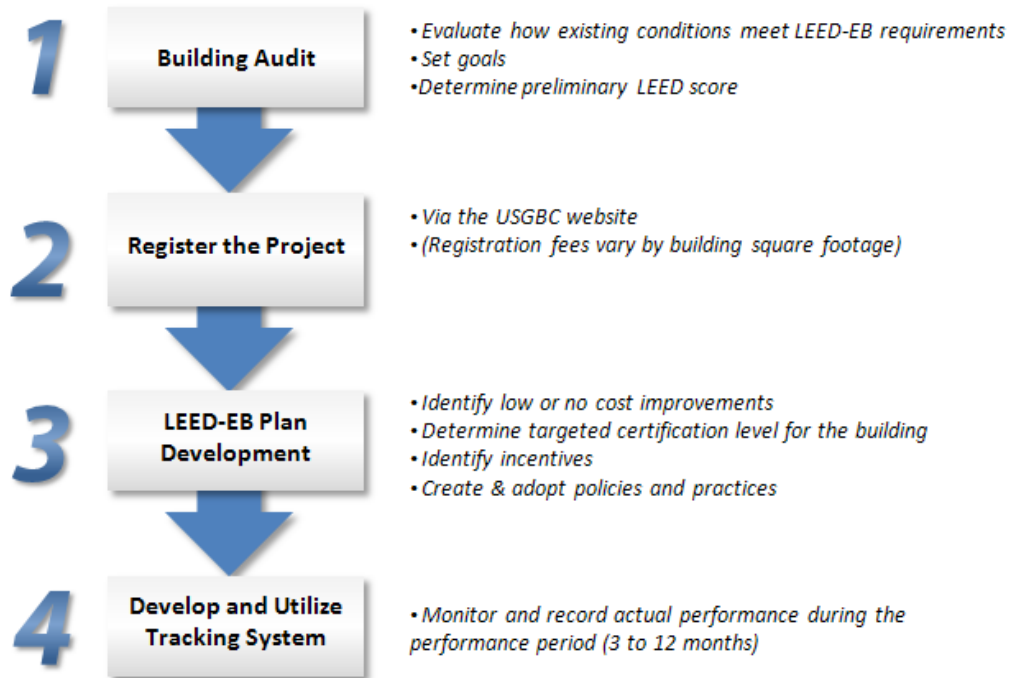


Figure 3: LEED-EB Process

Other Sustainability Metrics

Green Globes

Although LEED is the dominant green building certification system, other systems exist around the world. Outside of the U.S., countries have adopted their own green assessment systems, such as the UK's Building Research Establishment's Environmental Assessment Method (BREEAM) or Green Star in Australia. In Canada, the Green Globes system forms the basis of their BOMA national energy and environmental program and has been adopted by the Green Building Initiative for the U.S. *Green Globes Continual Improvement for Existing Buildings* provides a means for evaluating, rating and improving the sustainability of existing commercial buildings. Since Green Globes is an interactive web-based application, it is broader than LEED in terms of technical content and is considered to be more performance-oriented. The system is designed as an interactive tool and consists of eight questionnaires covering all project stages from initiation to commissioning. In order for a building to be promoted as Green Globes certified, it must undergo an audit and an on-site inspection by a qualified third-party verifier.

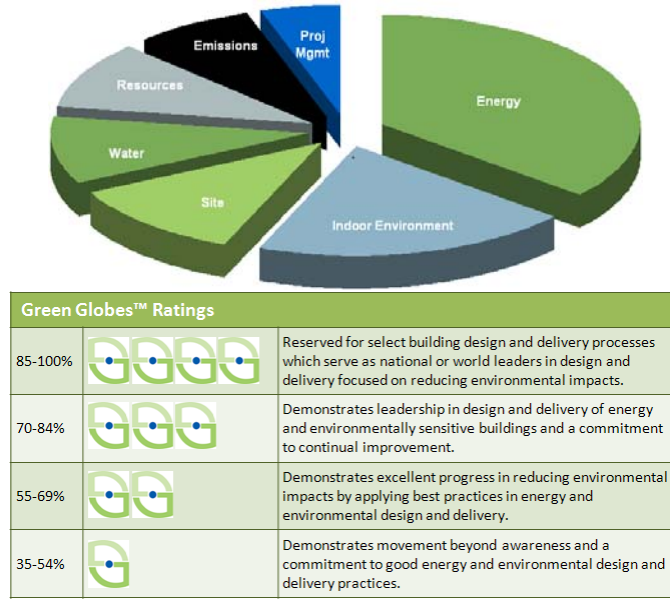


Figure 4: Green Globes - Areas of Assessment and Ratings⁸

Energy Star

The Energy Star Buildings program is a voluntary energy efficiency endeavor spearheaded by the U.S. Environmental Protection Agency (EPA) for U.S. commercial and industrial buildings. First introduced in 1999, this program seeks to highlight aspects of a building where proven conservation technology can be implemented in order to increase building profitability. Through these technological improvements, facilities professionals can enhance energy savings while lowering capital expenditures. The Energy Star program consists of a scorecard with a rating system of 1-100. Facilities that achieve a score of 75 or higher are eligible for the ENERGY STAR seal. Commercial buildings that have earned the ENERGY STAR seal use on average 35% less energy than typical similar buildings and generate one-third less carbon dioxide. Nationwide nearly 4,100 buildings of all types have now earned the Energy Star seal since the program was established.

⁸ Green Building Initiative - Seven Areas of Assessment: <http://www.thegbi.org/commercial/use-green-globes/test-drive/seven-areas-assessment.asp>

Space Type	Area (ft ²)	Workers	Operating Hours	Number of PCs
Office	15,000	40	40	40

Figure 5: Energy Star Statement of Energy Performance⁹

Other Programs for Sustainability

- **Green Lights** - A non-regulatory program sponsored by the Environmental Protection Agency (EPA) which encourages U.S. corporations to install energy-efficient lighting technologies. Corporations voluntarily become a Green Lights "Partner" by agreeing to install energy-efficient lighting wherever it is profitable, while maintaining or improving lighting quality.
- **EcoLogo** - Started by the Canadian government, EcoLogo certifies products as environmentally preferable after a stringent process that includes third party verification of compliance to EcoLogoM certification criteria.

⁹ http://www.energystar.gov/ia/business/evaluate_performance/pm_pe_guide.pdf

- **Green Seal** - An independent non-profit, third-party certifier and standards development organization in the U.S. started in 1981. It is the largest US-based ecolabeling organization and meets the EPA's Criteria for Third Party Certifiers, the requirements of ISO 14020 and 14024, and the standards of the Global Ecolabeling Network.

Technologies Supporting Sustainable Facilities

Sustainability and Technology in the AEC Project Process

BIM software applications facilitate the creation and use of three-dimensional building models along with a range of underlying project information for the architecture, engineering and construction practices. Along with supporting standard building design and documentation processes, BIM offers a means of analyzing building designs for sustainability requirements. Currently, the most developed sustainability feature within BIM is energy analysis and design.

The BIM technology arena is rapidly evolving with many standalone energy and sustainable design applications being acquired and integrated by major BIM vendors. There are several commonly used standalone software applications for evaluating energy usage in design projects, such as Energy-10, eQuest, ENERGY PLUS (DOE), DOE-2.1E and BLAST. BIM vendors are incorporating capabilities for their software to exchange data with these programs, as well as with other more vendor-specific programs for energy analyses (such as TRACE by Trane). A standard data format, gbXML (Green Building XML), has been developed to provide a standard data exchange mechanism between software applications, such as between BIM and energy modeling software.

BIM also offers the potential to affiliate and manage non-graphic data along with graphic representations of building components. This function offers great promise for tracking the range and breadth of information required for sustainable building design along with components visually represented in the model. Furthermore, BIM's capability to quantify components and affiliate costs and specifications offers the promise of quicker cost estimations of sustainable alternatives and more rapid specifications of sustainable products. However this is all still dependent on electronic product information being widely available for incorporation into building models. In current practice, delivery to owners and operators of fully detailed digital building models is yet to evolve, but soon will provide a rich information base for sustainable facility management.

Software Applications for Managing Sustainability in Facilities

There is a tremendous amount of diverse information to collect, analyze, and maintain when implementing green building initiatives. Technologies that track and manage sustainability for facilities are in the early and evolving state of development. In addition, software applications employed in facilities management such as CAFM, CMMS, and most recently, IWMS (Integrated Workplace Management Systems) are currently being enhanced to include tools for managing and tracking sustainability-related operations and assets.



Assessment and Planning

Software tools can assist sustainability planning by undertaking intensive data gathering tasks in key environmental areas including energy and water usage and costs, utility bill tracking, emissions data, solid waste generation, and systems efficiencies. IWMS applications are well-positioned to track this data, along with the standard operations data they traditionally track. For instance, Tririga - a leading IWMS vendor, has enhanced their IWMS offerings with a module - *TREES* (Tririga Real Estate Environmental Sustainability) to manage a range of sustainability areas.

Sustainability performance metrics are necessary for measuring a building's performance. Software tools can help track these indicators and can measure actual performance against industry-based benchmarks for cost, emissions and environmental performance. In addition to tracking data, robust software suites will also provide tools to review and analyze the information while mapping trends and performing what-if analysis.

"Green" condition assessment rating software can provide a current state baseline for any sustainability program. Condition assessment software vendors, such as VFA, are offering sustainability enhancements to their assessment applications. In addition, carbon footprint calculators and carbon credits are also useful analysis tools to provide feedback for corporate sustainability reporting. Furthermore, financially oriented analysis tools are generally part of an IWMS software suite and are valuable to planners in evaluating funding requirements and financial return of building retrofits.

Tools to track the criteria required for achieving LEED and Energy Star rating can be of great assistance in the certification process since it is documentation intensive. There are a few standalone applications available that are offered by equipment vendors such as the EPA's Energy Star Portfolio Manager which tracks and assesses energy and water consumption across a company's entire portfolio of buildings. These tracking tools are most useful when incorporated into a Facilities Management software suite.

The sophistication of reporting tools in an application is a critical feature for communicating sustainable performance information and establishing corporate buy-in. Reporting and documentation of performance and processes is a critical component in any continuing sustainability effort. Standard reports may include environmental impact, LEED summaries and checklists, expenditures and investments, energy and water usage, disposal and recycling. In addition, creating custom or ad-hoc reports is also crucial for supporting the workflow and planning process. Reporting and querying capabilities within these applications offer enhanced and easier means to extract, analyze, summarize and present information.

Assessing Lifecycle with Buildings & Products

Life Cycle Assessment (LCA) is a scientific methodology that holistically evaluates the environmental impact of a product throughout its life cycle. The USGBC is moving towards incorporating Life Cycle Assessment of building materials as part of the continuous improvement of LEED Green Building Rating System. Performing LCAs will be the province of the vendor, not the facility manager.

On the other hand, a lifecycle cost analysis, referred to as an LCCA, is a method for assessing the total cost of facility ownership. LCCA is especially useful to evaluate project alternatives that fulfill the same performance requirements, but differ with respect to initial costs and operating costs, to determine the option that maximizes net savings. Software for performing LCCAs is available from several sources.¹⁰

Building Performance and Monitoring

Building automation systems (BAS), when properly integrated into a facility, can help optimize energy, operations and indoor comfort over the lifetime of a building. BAS vendors have historically maintained proprietary data formats for their products, but frameworks are emerging that integrate and manage the range of systems in a building, creating what is termed as a *Smart Building*.

Building commissioning is no longer a prerequisite for LEED-EB although it is still a requisite for anyone who is serious about sustainability. Although expensive, commissioning quickly pays for itself through more efficient operations and an improved working environment for occupants. Commissioning software utilizes data retrieved from automated building systems for monitoring and evaluating performance. Applications to perform automated commissioning of building systems or continuous commissioning are early in their commercial implementation cycle. Smart building systems can offer the potential for increased sustainability with enhanced information supporting continuous commissioning.

¹⁰ See the Whole Building Design Guide website for several references. <http://www.wbdg.org/resources/lcca.php>

Appendix A: Glossary of Terms

Biodegradable: The process by which organic substances are broken down by the enzymes produced by living organisms.

BREEAM: Environmental assessment method for buildings. Developed by the UK's Building Research Establishment (BRE) and launched in 1990, it offers guidance and a certification process by licensed assessors to measure the environmental impact of a building.

Building Commissioning: A-E-C project management practice for achieving, verifying, and documenting that the performance of facilities, systems, and assemblies meets defined objectives and criteria. See [ASHRAE Guideline 0-2005: The Commissioning Process](#)

Carbon Neutral Buildings: Buildings that use no energy from external power grids and can be built and operated at fair market values (USGBC).

Computational Fluid Dynamics (CFD) - Computer modeling application to simulate dynamic flows and assist in predicting the performance of a design. In building design CFD is useful for modeling HVAC performances.

Cleantech: Knowledge-based products or services that improve operational performance, productivity, or efficiency while reducing costs, inputs, energy consumption, waste, or pollution.

Carbon Footprint: The total amount of greenhouse gases emitted directly or indirectly through any human activity, typically expressed in equivalent tons of either carbon or carbon dioxide.

Clean Air Act: Federal legislation passed in 1970 and amended in 1990 that authorizes the EPA to set National Ambient Air Quality Standards and to regulate industry in order to meet those maximum emissions levels.

Clean Water Act: Federal legislation passed in 1972 and amended in 1976 that requires the EPA to set maximum pollutant levels for each known contaminant in U.S. surface waters and authorizes the EPA to regulate industrial discharge in order to meet those standards.

Corporate Social Responsibility (CSR): The continuing commitment by businesses to behave ethically and contribute to economic development while improving the quality of life of the workplace as well as the local community and society at large; a company's obligation to be accountable to all of its stakeholders in all its operations and activities (including financial stakeholders as well as suppliers, customers, and employees) with the aim of achieving sustainable development not only in the economic dimension but also in the social and environmental dimensions

Cradle-to-Cradle: A design philosophy put forth by architect William McDonough that considers the life-cycle of a material or product, and ensures that the product is completely recycled at the end of its defined lifetime.

EcoLogo: Launched by the Canadian federal government in 1988, EcoLogo is a North American certifier of environmental standards. It has grown to serve buyers and sellers of green products in more than 120 categories. Meets the international ISO 14024 standard for environmental labels. www.ecologo.org

Embodied Energy: The quantity of energy required to manufacture and supply to the point of use a product, material or service. Can be considered an accounting methodology aiming to find the sum total of the energy necessary to produce a service or product and finally its disassembly, deconstruction and/or decomposition.

Energy Modeling: Using computer-based tools to simulate the energy use of a building.

Energy Services Companies (ESCOs): A company that offers to reduce a client's energy costs, often by capitalizing the upfront expenditures and sharing the resulting future cost savings with the client. This is typically accomplished through the use of an energy-performance contract (EPC) or a shared-savings agreement.

Energy Star: United States government program created in 1992 by the US Environmental Protection Agency in an attempt to reduce energy consumption and greenhouse gas emissions. For many types of existing buildings, you can rate energy performance on a scale of 1-100 relative to similar buildings nationwide. Buildings rating 75 or greater may qualify for the ENERGY STAR.

Environmental Audit: A systematic, documented, periodic and objective evaluation of how well a project, organization, individual, or service is performing in terms of environmental impact, including, but not necessarily limited to, compliance with any relevant standards or regulations

Environmental Impact Assessment (EIA): An assessment of potential environmental effects of development projects; required by the National Environmental Policy Act (NEPA) for any proposed major federal action with significant environmental impact

Environmental Management System (EMS): A set of processes and practices that enable an organization to reduce its environmental impacts and increase its operating efficiency. www.epa.gov/EMS/

Environmental Risk Assessment (ERA): The tracking and rating of environmental risks, such as emissions, associated with a product and its manufacturing

Executive Order (EO) 13423: Federal Executive Order enacted on January 24, 2007 that consolidates and strengthens a number of prior EOs by establishing new and updated goals, practices, and reporting requirements for environmental, energy, and transportation performance and accountability for federal agencies. http://ofee.gov/eo/eo13423_main.asp

Facility Performance Evaluation (FPE): An extension of what had been called "post-occupancy evaluation." A continuous process of systematically evaluating the performance and/or effectiveness of one or more aspects of buildings in relation to issues such as accessibility, aesthetics, cost-effectiveness, functionality, productivity, safety and security, and sustainability.

FSC Certified. The forest Stewardship Council's certification indicates that forests are managed and harvested responsibly, with the goal of preserving forests for future generations.

gbXML: Data format developed to facilitate the transfer of building information stored in CAD building information models, enabling integrated interoperability between building design models and a wide variety of engineering analysis tools and models. A subset of XML, extensible markup language - a g

Green Building: A comprehensive process of design and construction that employs techniques to minimize adverse environmental impacts and reduce the energy consumption of a building, while contributing to the health and productivity of its occupants; a common metric for evaluating green buildings is the LEED (Leadership in Energy and Environmental Design) certification

Green Globes: A green management tool that includes an assessment protocol, rating system and guide for integrating environmentally friendly design into commercial buildings. Originating in Canada as an outgrowth of the UK's BREEAM, now available in the US and is directed by the Green Building Initiative at www.thegbi.org.

GreenGuard Certification: An industry-independent, nonprofit organization that establishes acceptable indoor air standards for indoor products, environments and buildings. www.greenguard.org

Green Seal - A non-profit, third-party certifier and standards development body in the US that provides independent, objective, science-based guidance to the marketplace and to consumers. A Green Seal Certification Mark on a product means that it has gone through a stringent process to show that it has less impact on the environment and human health.

Greenhouse Gas (GHG): A gas that contributes to the natural greenhouse effect, whereby heat is trapped within the Earth's atmosphere, including: carbon dioxide, methane, nitrous oxide, hydrofluorocarbons, perfluorocarbons and sulfur hexafluoride.

Green Lights: US EPA voluntary program designed to reduce pollution, promote public-private partnership, encourage environmental leadership, and cut participants' energy costs by using energy-efficient lighting. <http://www.epa.gov/Region7/p2/volprog/grnlight.htm>

Greenwashing: The process by which a company publicly and misleadingly declares itself to be environmentally-friendly but internally participates in environmentally- or socially-unfriendly practices

LEED - Leadership in Energy and Environmental Design: An initiative sponsored by the United States Green Building Council (www.usgbc.org) that creates standards for developing high performance, sustainable buildings

Life Cycle Assessment (LCA): A process of evaluating the effects of a product or its designated function on the environment over the entire period of the product's life in order to increase resource-use efficiency and decrease liabilities; commonly referred to as "cradle-to-grave" analysis.

Lifecycle Cost Analysis (LCCA): An engineering economic analysis tool that quantifies the differential costs of alternative investment options for a given project.

Pre-consumer materials: Generated by manufacturers and processors, and may consist of scrap, trimmings and other by-products that were never used in the consumer market.

Post-consumer material: An end product that has completed its life cycle as a consumer item and would otherwise have been disposed of as a solid waste. Post-consumer materials include recyclables collected in commercial and residential recycling programs, such as office paper, cardboard, aluminum cans, plastics and metals.

Rapidly Renewable Material: Materials that substantially renew themselves faster than traditional extraction demand (i.e., planted and harvested in less than a 10 year cycle) and do not result in significant biodiversity loss, increased erosion, or air quality impacts.

Recycled Content: An item that contains recovered materials. Recovered materials are wastes that have been diverted from conventional disposal such as landfills for another use and include both pre-consumer and post-consumer wastes.

Retro-commissioning (RCx) or Existing Building Commissioning is a systematic, documented process that identifies low-cost operational and maintenance improvements in existing buildings and brings the building up to the design intentions of its current usage.

Sustainability: Successfully meeting present social, economic, and environmental needs without compromising the ability of future generations to meet their own needs; derived from the most common definition of sustainability, created in 1987 at the World Commission on Environment and Development.

Sustainably Harvested Wood: Sustainable forestry selects specific trees on a limited basis with the goal of restoring the original balance of plant and animal species. Independent agencies certify forestry operations

Triple Bottom Line: An expansion of the traditional company reporting framework of net financial gains or losses to take into account environmental and social performance.

United States Green Building Council (USGBC), a non-profit organization dedicated to sustainable building design and construction, and developers of the LEED building rating system.

VOC: Volatile organic compounds are organic chemical compounds that have high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. Considered a factor in indoor air quality issues, VOCs are generated by photocopiers, carpets, and furnishings as they are used or when components oxidize.

Zero Energy Buildings (ZEB) - A general term applied to a building with a net energy consumption of zero over a typical year.

Appendix B: References

WEBSITES:

BEES (Building for Environmental and Economic Sustainability)

Decision support software, aimed at designers, builders, and product manufacturers, includes actual environmental and economic performance data for 230 building products.

<http://www.bfrl.nist.gov/oea/software/bees/>

BOMA - The G.R.E.E.N. (The Green Resource Energy and Environment Network)

<http://www.boma.org/AboutBOMA/TheGREEN/>

Dictionary of Corporate Responsibility & Sustainability Terms

<http://www.brownflynn.com/RESOURCECENTER/Glossary/tabid/221/Default.aspx>

BuildingGreen

Informational website for the North American building industry on green building practices and products. www.buildinggreen.com

Dictionary of Sustainable Management

http://www.sustainabilitydictionary.com/e/energy_service_company_esco.php

Department of Energy (DOE) - Building Technologies Program

Energy efficient technologies, resources, software tools. Buildings.energy.gov.

Energy Star for Buildings

EPA Energy rating system for buildings.

http://www.energystar.gov/index.cfm?c=green_buildings.green_buildings_index

Federal Energy Management Program (FEMP)

Sustainable Design & Operations Resources —include publications, Web sites, and training opportunities. http://www1.eere.energy.gov/femp/sustainable/sustainable_resources.html

Green Building Initiative and Green Globes

Organization with sustainable building programs and Green Globes assessment and rating too.

www.thegbi.org

GreenerBuildings

Resource on designing, constructing, and operating environmentally responsible commercial and industrial buildings, created in partnership with the U.S. Green Building Council.

www.greenerbuildings.com

Leonardo Academy

Non-profit consulting firm directed towards increasing sustainability in the environment, with a notable focus on existing buildings. <http://www.leonardoacademy.org/>

United States Green Building Council and LEED

Organization for promoting green buildings and offering the LEED Green Building Rating system.
www.usgbc.org

Whole Building Design Guide.

Web-based tool providing information and resources to support sustainable design. Sustainable Design <http://www.wbdg.org/design/sustainable.php>

ARTICLES and DOCUMENTS**BOMA Canada's GO GREEN Program**

Tools and information related to this Canadian environmental recognition and certification program for existing commercial buildings. <http://www.bomagogreen.com>

Building Green

Information about sustainable building materials and methodology.
<http://www.buildinggreen.com>

Building Cost and Performance Metrics: Data Collection Protocol.

Pacific Northwest National Laboratory. September 2005. Fowler, Solana and Spees.
www1.eere.energy.gov/femp/pdfs/pnnl15217.pdf

Deliver the Green.

A Leonardo Academy white paper courtesy of the IFMA Green Zone on LEED-EB and facility management. www.ifmafoundation.org/deliverthegreen.pdf

Gauging Green Opportunities.

Facility Management Journal, IFMA. November/December 2007 www.fmjonline.com. Susan Buchanan.

Green Building Rating Systems

A comparison of the LEED and Green Globes Systems in the US. September 2006. Timothy M. Smith, Miriam Fischlein, and others. University of Minnesota. The Carpenters Industrial Council.
<http://www.foresthealth.org/pdf/LEED%20Comparison%20Study.pdf>

Greening Federal Facilities, Second Edition (2001).

<http://www1.eere.energy.gov/femp/pdfs/29267-0.pdf>

Justifying Sustainable Buildings – Championing Green Operations.

Kathy O. Roper, Jeffrey L. Beard. Journal of Corporate Real Estate. 2006 Volume: 8 Issue: 2
Page: 91 - 103

LEED-EB: How to Achieve Certification and Reduce Operating Costs.

Ed Iczkowski. <http://txspace.tamu.edu/handle/1969.1/5134> Energy Systems Laboratory. 2005.

Standard Guide for General Principles of Sustainability Relative to Buildings (ASTM E 2423).

http://www.astm.org/SNEWS/NOVEMBER_2007/meadows_nov07.html

The Costs and Financial Benefits of Green Buildings: A Report to California's Sustainable Building Task Force, October 2003.

Includes LEED building analysis. <http://www.usgbc.org/Docs/News/News477.pdf>

About Louise Sabol

Louise A. Sabol is a registered architect with more than 25 years of experience in the building and technology professions. At Design + Construction Strategies, LLC, Ms. Sabol serves as Director of Technology, providing overall technical planning for the firm's technology integration projects for organizations involved in complex capital projects.

About Design + Construction Strategies, LLC

DCStrategies is dedicated to business technology implementation and the creation of IT-enabled culture in the AEC community.

Our clients include the U.S. Department of State, the General Services Administration, the International Code Council, Autodesk, Inc. and Greenway Consulting.

More information is available at www.dcstrategies.net.

Design + Construction Strategies, LLC
11 Dupont Circle, Suite 601
Washington, DC 20036
(202) 222-0610
www.dcstrategies.net

Copyright © 2008 Design + Construction Strategies. All rights reserved.

Design + Construction Strategies and the Design + Construction Strategies logo are trademarks of Design + Construction Strategies. Other names may be trademarks of their respective owners.