

Notebook: Planning Commission
Created: 12/10/2018 9:37 AM
URL: <https://www.wbdg.org/resources/green-building-standards-and-certification-systems>

GREEN BUILDING STANDARDS AND CERTIFICATION SYSTEMS

by Stephanie Vierra, Assoc. AIA, LEED AP BD+C

Vierra Design & Education Services, LLC

Updated: 12-09-2016

INTRODUCTION

Buildings have extensive direct and indirect impacts on the environment. During their construction, occupancy, renovation, repurposing, and demolition, buildings use energy, water, and raw materials, generate waste, and emit potentially harmful atmospheric emissions. These facts have prompted the creation of green building standards, certifications, and rating systems aimed at mitigating the impact of buildings on the natural environment through **sustainable** design.

The push toward sustainable design increased in the 1990s with the creation of Building Research Establishment's Environmental Assessment Method (**BREEAM**), the first green building rating system in the U.K. In 2000, the U.S. Green Building Council (**USGBC**) followed suit and developed and released criteria also aimed at improving the environmental performance of buildings through its Leadership in Energy and Environmental Design (**LEED**) rating system for new construction. Since that first release, LEED has continued to grow in prominence and to include rating systems for existing buildings and entire neighborhoods. Others also responded to the growing interest and demand for sustainable design including the Green Building Initiative (**GBI**), which was created to assist the National Association of Homebuilders (**NAHB**) in promoting its Green Building Guidelines for Residential Structures. Although originally developed for Canada, GBI helped to make Green Globes available for use in the U.S. in 2005. Additional rating systems have been developed that were influenced by these early programs but are tailored to their own national priorities and requirements or seek to go beyond the limits of current policy and building practices to address broader issues of sustainability or evolving concepts such as **net zero energy**, and **living and restorative building concepts** that improve the natural environment, or those that model nature's processes.

Green product standards also began to appear in the marketplace in the 1980s and increased in the 1990s. Initially, many green product standards were developed in response to growing concerns for product toxicity and its impact on children's health and indoor environmental quality (**IEQ**). In the 21st century, when growing concerns over global warming and resource depletion became more prominent and supported by research, the number and type of green product standards and certifications grew. The focus also expanded to include a broader range of environmental issues and the impacts of products during their manufacture, use, and reuse. While there is still no

WITHIN THIS PAGE

- [Introduction](#)
- [Description](#)
- [Emerging Issues](#)
- [Relevant Codes and Standards](#)
- [Additional Resources](#)

universal definition of a green product, these products are intended to meet claims that they offer environmental benefits and adhere to certain standards. (See also [Use Greener Materials](#))

There is now a proliferation of standards, rating, and certification programs in the marketplace to help guide, demonstrate, and document efforts to deliver sustainable, high-performance buildings. It is estimated that there are nearly 600 green product certifications in the world with nearly 100 in use in the U.S., and the numbers continue to grow (Source: [BuildingGreen](#)). There are also green building rating programs in use around the world and they vary in their approach with some outlining prerequisites and optional credits, while others take a prescriptive approach, and still others suggest performance-based requirements that can be met in different ways for different products and project types. As a result, it can be challenging and time consuming determining which standards, certifications, and rating programs are most credible and applicable to a particular project. This page will provide an introduction to some commonly used terms and an overview of the most widely recognized green building product standards, and building rating and certification programs currently in use with an emphasis on how they vary and some of the issues to consider when selecting them.

DESCRIPTION

A. BUILDING STANDARDS

A **standard** is a set of guidelines and criteria against which a product can be judged. Common standards related to building practices are created through consensus processes by organizations such as [ANSI](#), [ASTM](#), or [ASHRAE](#). Supporting the governance of standards and certifications is the International Standards Organization ([ISO](#)), which defines and develops worldwide standards that frequently become law or form the basis of industry norms. ISO defines a standard as: "a document, established by consensus, approved by a recognized body that provides for common and repeated use as rules, guidelines, or characteristics for activities or their results."

Requirements found in standards may either be prescriptive (identifying methods of achievement) or performance based (stating expectations of end results). Consensus based standards, those developed through a formal, voluntary consensus process that is exemplified by an open and due process have immediate buy-in, government support, and international influence. According to the [National Technology Transfer and Advancement Act](#) (NTTAA) federal agencies are required by law to adopt existing private-sector voluntary consensus standards instead of creating proprietary, non-consensus standards. Standards frequently serve as incentives for improved performance. Many of the green product standards available today are proprietary or regulatory standards that have been developed outside of the formal ANSI and ISO consensus process. These types of standards may be more or less stringent than consensus standards and can include some level of transparency and public comment. However, many of these types of standards are trusted because they are associated with a group that has strong environmental credentials.

The ANSI/ASHRAE/USGBC/IES Standard 189.1, *Standard for the Design of High Performance Green Buildings except Low-Rise Residential Buildings* provides minimum requirements for site, design, construction and operations in mandatory, code-enforceable language. This standard is comprehensive and includes chapters for site, water, energy efficiency, indoor environmental quality, and materials. For a detailed description on many other building codes and standards that address sustainability goals and requirements, see the Relevant Codes and Standards section below and [Energy Codes and Standards](#).

B. GREEN CODES

Green building codes continue to be developed and adopted in the U.S. and abroad that seek to push the standard of building design and construction to new levels of sustainability and performance. Codes come in two basic formats: *prescriptive* and *performance*, with *outcome-based* becoming a developing third option. A **Prescriptive** path is a fast, definitive, and conservative approach to code compliance. Materials and equipment must meet a certain levels of stringency, which are quantified in tables. **Performance-based codes** are designed to achieve particular results, rather than meeting prescribed requirements for individual building components. **Outcome-based codes** for example, establish a target energy use level and provide for measurement and reporting of energy use to assure that the completed building performs at the established level. (See also: [Outcome-Based Pathways for Achieving Energy Performance Goals.](#))

The unique difference between codes and building rating systems is that codes are mandatory. If green codes become adopted on a wide spread basis, their impact can change the building environment rapidly and extensively. When undertaking a project, whether it is new construction or a renovation, check to see if there is a state or local green code that will dictate the direction and scope your project must take.

The [International Green Construction Code \(IgCC\)](#) provides a comprehensive set of requirements intended to reduce the negative impact of buildings on the natural environment. It is a document which can be readily used by manufacturers, design professionals and contractors; but what sets it apart in the world of green building is that it was created with the intent to be administered by code officials and adopted by governmental units at any level as a tool to drive green building beyond the market segment that has been transformed by *voluntary* rating systems.

It was developed by the International Code Council (ICC) in association with cooperating sponsors ASTM International (ASTM) and the American Institute of Architects (AIA). Other organizations indicating their support include the U.S. Green Building Council (USGBC), and The Green Building Initiative (The GBI), producers of the Green Globes rating system. The IgCC was developed with the intent to be consistent and coordinated with the ICC family of Codes & Standards: the I-Codes. It is applicable to the construction of high performance commercial buildings, structures, and systems, including existing buildings subject to alterations and additions, utilizing both traditional and innovative construction practices. Residential occupancies are covered by reference to the ICC 700 National Green Building Standard (NGBS). High-rise residential buildings, however, may conform to either the IgCC or ICC 700. The IgCC also allows jurisdictions to choose ANSI/ASHRAE/USGBC IES Standard 189.1 as jurisdictional compliance option. ASHRAE Standard 189.1, *Standard for High-Performance Green Buildings Except Low-Rise Residential Buildings*, is an American National Standards Institute (ANSI) standard developed by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) in association with the Illuminating Engineering Society (IES) and the U.S. Green Building Council (USGBC). Because it was written in *mandatory* language, the IgCC is poised to produce environmental benefits on a massive scale: a scale impossible to attain with purely *voluntary* green building programs and rating systems.

The California Green Building Standards Code (CALGreen Code) is Part 11 of the [California Building Standards Code](#) and was the first statewide "green" building code in the US. CAL Green is designed to save water and promote environmentally responsible, cost-effective, healthier places to live and work. The purpose of CALGreen is to improve public health, safety and general welfare by enhancing the design and construction of buildings through the use of building concepts having a reduced negative impact or positive environmental impact and encouraging sustainable construction practices in the following categories:

- Planning and design
- Energy efficiency
- Water efficiency and conservation
- Material conservation and resource efficiency
- Environmental quality

C. GREEN PRODUCT CERTIFICATIONS

A **certification** is a confirmation that a product meets defined criteria of a standard. ISO defines certification as: "any activity concerned with determining directly or indirectly that relevant requirements are fulfilled."

Green product certifications are intended to outline and confirm that a product meets a particular standard and offers an environmental benefit. Many product labels and certification programs certify products based on life-cycle parameters, making them *multi-attribute* programs. These parameters include energy use, recycled content, and air and water emissions from manufacturing, disposal, and use. Others focus on a *single attribute*, such as water, energy, or chemical emissions that directly impact IEQ.

A green product certification is considered most respected when an independent third party is responsible for conducting the product testing and awarding the certification. Third-party means they are independent of the product manufacturer, contractor, designer, and specifier. Third-party labels and green product certification programs can be helpful in evaluating the attributes of green products because they validate that the product meets certain industry-independent standards. They can also offer greater assurance to consumers, designers, specifiers, and others that a product's marketing claims accurately reflect its green attributes. Many product certifications are also recognized within comprehensive green building rating systems such as LEED, Green Globes, and the National Green Building Standard. As a result, green product certifications are on the rise as market conditions change and the demand for greener products continues to increase. It is important to note that greenwashing, which is defined as the use of green claims that are not true or are unverifiable but used to sell products or a corporate image, has become commonplace as companies try to stay competitive in the green marketplace.

To fully understand what a green certification represents and the quality of information it provides, the details of its requirements need to be reviewed carefully. The ISO defines different types of labels that can be used for products. Below is an outline of the ISO-defined labels and what is being claimed. Product certifications available in the U.S. are mostly Type I and Type II labels while Type III labels are now required in France and becoming more common in Europe and for those U.S. manufacturers with an international focus.

ISO-DEFINED TYPES OF GREEN PRODUCT CERTIFICATION LABELS

TYPE	ISO NUMBER	WHAT THE LABEL DOES
Type I	ISO 14024	Seal of approval for multi-attribute requirements
Type II	ISO 14021	Verifiable single-attribute environmental claims for issues such as energy consumption, emissions, or recycled content. Can be first-party, self-declared manufacturer claims. However many manufacturers are beginning to seek third-party verification of those claims in response to industry demand.
Type III	ISO >14025	Comprehensive environmental product disclosure and detailed product information. Similar to an Environmental Product Declaration (EPD)

SUMMARY OF GREEN PRODUCT CERTIFICATIONS

The following table, and the expanded information directly below it, outlines some of the most commonly used and respected green product certifications in the marketplace. Please see the Additional Resources section for more

information on other programs not included in this page.

PRODUCT CERTIFICATION	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUE OF FOCUS
Energy Star	Single-Attribute	Government certification relying on manufacturer-provided data or third-party testing	U.S. EPA and U.S. DOE	Energy consuming products
WaterSense	Single-Attribute	Government label based on third-party testing	U.S. EPA	Showerheads, toilets, faucets, urinals, and valves
Forest Stewardship Council	Single-Attribute	Third-party certification	Forest Stewardship Council (FSC)	Forests and forestry products
SCS Global Services	Multi-Attribute	Third-party certification	SCS Global Services	Wide range of products (i.e. carpets, textiles, wood products, insulation, and more)
Green Seal	Multi-Attribute	Third-party ISO Type 1 certification	Green Seal	Wide range of sectors (paints, adhesives, lamps, electric chillers, windows, window films, occupancy sensors)
Cradle to Cradle	Multi-Attribute	Third-party certification, Cradle to Cradle Certified ^{CM} Product Standard is managed and updated by the Institute's Certification Standards Board	Cradle to Cradle Products Innovation Institute C2CPII	Building materials, interior design products, textiles and fabrics, paper and packaging, and personal and homecare products
GREENGUARD	Multi-attribute	Third party certification	UL Environment	Indoor air quality, children and schools focus

PRODUCT CERTIFICATION	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUE OF FOCUS
Green Squared	Multi-attribute	Third-party ISO Type 1 environmental labeling and declaration requirements (ISO 14024)	TCNA	Tiles and tile installations

SINGLE-ATTRIBUTE PRODUCT CERTIFICATIONS



ENERGY STAR—First established in 1992 as a voluntary labeling program, Energy Star is a widely recognized government-run product certification label for energy efficient products. It is a joint program of the U.S. EPA and DOE. Energy Star-certified products include appliances, heating and cooling equipment, lighting, home electronics, commercial roofing, and office equipment.

Energy Star standards are generally updated and made more stringent every two years. (See also Single-Attribute Building Rating System below.)

The [Energy Policy Act of 2005 \(EPACT\)](#) requires federal agencies to buy either Energy Star products or products designated as energy efficient by the Federal Energy Management Program (FEMP), for which the requirements are included in the [Federal Acquisition Regulation \(FAR\) Subpart 23.203](#). [Executive Order 13423](#) requires federal agencies to activate Energy Star "sleep" features on computers and monitors and mandates that federal agencies buy [EPEAT*](#) registered products. (For more information addressing federal requirements for Energy Star, click [here](#))



WaterSense—a partnership program by the U.S. EPA, WaterSense seeks to protect the future of our nation's water supply by offering people a simple way to use less water with water-efficient products, new homes, and services. Established in 2006 for water-efficient products, the program seeks to help consumers make smart water choices that save money and maintain high environmental standards without compromising performance. WaterSense products and services that have earned the label must be at least 20 percent more efficient without sacrificing performance. Look for the "WaterSense: Meets EPA Criteria" label, not just "WaterSense Partner". The "partner" label indicates that an organization or manufacturer has signed an agreement with EPA to promote water efficiency but does not address performance of a specific product.

[Executive Order 13423](#) requires federal agencies to implement water-efficiency measures, including the purchase, installation, and implementation of water-efficient products and practices. Beginning in fiscal year 2008, agencies must reduce water consumption intensity, relative to their fiscal year 2007 baseline, through cost-effective life-cycle measures by 2 percent annually (or 16 percent total) by the end of fiscal year 2015.



Forest Stewardship Council (FSC)—is a third-party certification program established in 1993 with the goal of promoting responsible forestry and certifying the resulting wood products. The standard is managed by the FSC while certification is awarded by third parties such as the Rainforest Alliance and Scientific Certification Systems. There are different standards for different forest products (FSC pure, FSC mixed, and FSC recycled) and different regions. The FSC chain of custody is a requirement of certification that follows the path of the wood product from forest to consumer. The FSC program uses a specific, prescriptive approach and provides assurance of good environmental and social stewardship of forests.



SCS Global Services—is a third-party certification of claims for recycled content, biodegradable liquid products, and no-added formaldehyde products. SCS Global Services is a long-respected certifier that backs its certifications with vigorous and transparent standards. A number of products with this certification meet indoor air quality, recycled content, and FSC chain-of-custody requirements within green building rating systems such as LEED.

MULTI-ATTRIBUTE PRODUCT CERTIFICATIONS



Green Seal—is a third-party certification and labeling program that covers a wide range of products with sector-specific requirements, particularly consumable items for building operations. Green Seal has been certifying products since 1992 and is an ISO 14024 Type I program. Green Seal considers the impacts of a product over its entire life cycle when developing a standard. Building products covered include paints, adhesives, lamps, electric chillers, windows, window films, and occupancy sensors. Green Seal is referenced in several LEED rating systems, and cleaning products for industrial and institutional use are referenced in LEED for Existing Buildings in Operations and Maintenance.



The Cradle to Cradle Certified^{CM} program is a third party, multi-attribute eco-label administered by the Cradle to Cradle Products Innovation Institute that assesses a product's safety to humans and the environment and design for future life cycles. The program provides guidelines to help businesses implement the Cradle to Cradle framework, which focuses on using safe materials that can be disassembled and recycled as technical nutrients or composted as biological nutrients. Unlike single-attribute eco-labels, the Cradle to Cradle Certified program takes a comprehensive approach to evaluating the design of a product and the practices employed in manufacturing the product. The materials and manufacturing practices of each product are assessed in five categories: Material Health, Material Reutilization, Renewable Energy Use, Water Stewardship, and Social Responsibility.



GREENGUARD—is a third-party certification and label established in 2001. GREENGUARD Children and Schools certification complies with [California Section 01350](#), calling for emissions at half of California's more stringent thresholds. GREENGUARD certifies that a product meets thresholds for formaldehyde, total aldehydes, total volatile organic compounds (VOCs), and one-tenth of the threshold limit value (a regulatory benchmark) for many other compounds. The GREENGUARD Environmental Institute certifies products that comply with their rigorous formaldehyde, emissions, and chemical testing requirements.



Green Squared—Certification was developed by TCNA, and involves one industry, one standard, and one mark and covers products used in a tile installation. As the first multi-attribute sustainability standard developed for tiles and tile installation materials, Green Squared uses the transparency and consensus of the ANSI process combined with third party certification to evaluate, validate, and communicate products which have a positive impact on the environment and society. Green Squared covers product characteristics, manufacturing, end of product life management, progressive corporate governance, and innovation in an effort to establish sustainability criteria for products throughout their full life cycle. Green Squared acknowledges products which have been verified to be in conformance with ANSI A138.1. The easily-recognizable Green Squared mark helps architects, designers, and end users choose products and assured that the products they are choosing meet the industry's broad range of sustainability criteria.

A new category and approach to identifying and declaring the manufacturing, production, ingredients and make up of a product is rapidly emerging. Whether it is an **Environmental Product Declaration (EPD)**, a **Health Product Declaration (HPD)**, a **Declare Label**, or the **Living Product Challenge**, there is a growing movement to seek full disclosure of a product within a life cycle framework and create a world of products that do no harm and improve the environment. Additionally, the **JUST Label** seeks to address social responsibility through transparency. These labels are starting to be accepted or required within the various green building rating systems, although labels do not yet exist for all products. For example, in LEED there is an option within the Materials and Resources category to achieve a credit for transparency about the environmental impact of a product by utilizing an EPD. The Declare label is in use within the Living Building Challenge to meet the stringent materials requirements.

An **Environmental Product Declaration (EPD)** is an independently verified and registered document that communicates transparent and comparable information about the life-cycle environmental impact of products. The International EPD System is a global program for environmental declarations based on ISO 14025 and EN 15804. Their database currently contains more than 500 EPDs registered by 150 companies in 27 countries. Having an EPD for a product does not imply that the declared product is environmentally superior to alternatives. It is simply a transparent declaration of the life-cycle environmental impact. The relevant standard for Environmental Product Declarations is ISO 14025, where they are referred to as "type III environmental declarations". A type III environmental declaration is created and registered in the framework of a program, such as the International EPD System. An EPD may be used for many different applications, including green public procurement (GPP) and building assessment schemes. See: environdec.com for more information.

Designers, specifiers, and owners are increasingly seeking transparent information on the ingredients in building products, and their associated health hazards. **Health Product Declarations (HPD)** provide a full disclosure of the potential chemicals of concern in products by comparing product ingredients to a wide variety of "hazard" lists published by government authorities and scientific associations. To achieve third party verification, the HPD must have 100% disclosure of known ingredients and/or 100% disclosure of known hazards down to 1000 ppm. The Health Product Declaration (HPD) Open Standard consists of a defined Format and Instructions for reporting about the contents of building products along with the associated health and other related information. The Standard is maintained and sponsored by the Health Product Declaration Collaborative. Version 2.0 of the HPD Open Standard was released in September 2015. In April 2016, the US Green Building Council issued an [interpretation](#) of the LEED v4 Building Product Disclosure and Optimization—Material Ingredients, Option 1 that includes clarification of how the Health Product Declaration 2.0 can be used to meet the requirements of the credit. For more information see the [The Health Product Declaration® Collaborative \(HPDC\)](#).

Human and environmental health considerations have emerged as a crucial factor in material selection. **Declare** is a platform for manufacturers of ecologically sound products to demonstrate market leadership and secure a competitive advantage. Declare takes complex chemical analysis and raw material source location information and provides it to consumers in an elegant, easy to use 'nutrition label'. Declare gives manufacturers an expanded point of entry into the most groundbreaking restorative projects in the world. Project teams pursuing the Living Building Challenge can use the Declare product database and label to select products that meet the Living Building Challenge's stringent materials requirements, streamlining the materials specification and certification process. Declare also meets the requirements of the proposed LEED v4 materials inventory and toxic chemical avoidance credit. The Declare label is valid for a 12-month period. After this period manufacturers must renew by paying a renewal fee and either confirming that the information contained within the Product Declaration Form has not changed or submitting a new form. See: [Living Future— Declare](#) for more information.

According to the International Living Future Institute, "**The Living Product Challenge**" is a philosophy first, an advocacy tool second and a certification program third. It is intended to guide the manufacturing of thousands of things people are surrounded by on a daily basis, and to give direction and support to those who make the goods

that are used. Within the larger Living Future Challenge framework that covers the creation of Living Buildings, Communities and Food Systems, the Living Product Challenge focuses on manufactured goods. It is a unified tool for transformative thought, allowing a future to be envisioned that is Socially Just, Culturally Rich and Ecologically Restorative. The Living Product Challenge is comprised of seven performance categories, or "Petals": *Place, Water, Energy, Health and Happiness, Materials, Equity and Beauty*. Petals are subdivided into a total of 20 Imperatives, each of which focuses on a specific sphere of influence. This compilation of Imperatives can be applied to almost every conceivable product, of any size, manufactured in any location—be it a new innovation or a reinvention of an existing item." For more information see: [Living Product Challenge](#).

The International Living Future Institute's **JUST** program is a voluntary disclosure program and tool for all types and sizes of organizations. JUST is a call to social justice action. It is not a verification or certification program. Rather, the program provides an innovative transparency platform for organizations to reveal much about their operations, including how they treat their employees and where they make financial and community investments. In a similar fashion to the Living Building Challenge's Declare Program, the JUST Program acts somewhat as a "nutrition label" for socially just and equitable organizations. This approach requires reporting on a range of organization-and employee-related indicators. Each of the indicator metrics asks for simple yet specific and measurable accountabilities in order for the organization to be recognized at a One, Two, or Three Star Level, which is then summarized elegantly on a label. Organizations can use the label on their website or marketing to demonstrate their commitments to these issues. JUST marks the beginning of a new era of corporate transparency. See: [About JUST](#) for more information.

D. GREEN BUILDING RATING AND CERTIFICATION SYSTEMS

Both standards and product certifications will play a role in determining the level of sustainability or performance of a product. However, each must be considered as part of a larger process of [integrating](#) them into the overall project goals to ensure the entire project is sustainable.

Green building rating or certification systems broaden the focus beyond the product to consider the project as a whole. Rating systems are a type of building certification system that rates or rewards relative levels of compliance or performance with specific environmental goals and requirements. Rating systems and certification systems are frequently used interchangeably.

Green building rating and certification systems require an [integrated design process](#) to create projects that are environmentally responsible and resource-efficient throughout a building's life-cycle: from siting to design, construction, [operation, maintenance](#), renovation, and demolition. A few of these programs are *single-attribute*, focusing solely on water or energy, while others are *multi-attribute* addressing emissions, toxicity, and overall environmental performance in addition to water and energy. While the philosophy, approach, and certification method vary across these the systems, a common objective is that projects awarded or certified within these programs are designed to reduce the overall impact of the built environment on human health and the natural environment.

Green building rating systems exist to address every project type from single-family houses and commercial buildings to entire neighborhoods. There are rating systems available for new construction, which focus on decisions made in the planning and design process and actions taken through construction, as well as for existing buildings, which focus on operations and maintenance throughout the life of the building. A primary reason for the creation of rating systems is the need to more clearly define, implement, and measure green. Federal, state, and municipal agencies across the country such as the [General Services Administration \(GSA\)](#), [Department of Energy](#), [Department of Health and Human Services](#), and the [Environmental Protection Agency](#), have taken an early lead in incorporating energy efficiency and sustainability by following green building guidelines in the design,

construction, and renovation of Federal facilities. Most states and many major cities have also incorporated green into their internal building requirements for new construction.

To determine which standard, certification, or rating system should be used, ask the following:

- Who the organization is that is making the assessment?
- Is it being done by a first-party, second-party, or third-party?

A first-party assessment is one that comes directly from an organization that is associated with the entity making the claim or who may benefit from the claim. A second-party assessment is performed by an interested party such as a trade association. A third-party assessment is conducted by an independent party that has no financial interest or ties to the outcome of the assessment.

According to [RSMeans](#) there are four principles that should be considered when evaluating a building rating or certification system:

- Science-based — Results and decisions must be reproducible by others using the same standard.
- Transparent — Standards and process for awarding the certification should be transparent and open for examination.
- Objective — Certification body should be free of conflict.
- Progressive — Standards should advance industry practices, not simply reward business as usual.

WHY PURSUE A GREEN BUILDING RATING OR CERTIFICATION?

The reasons for pursuing a green building certification for a project are varied. Certification through any rating system provides verification of the green nature of the project, and can be a valuable educational and marketing tool for owners and design and construction teams through the process of creating a more sustainable building. Green building certification can also be a way to provide an incentive for clients, owners, designers, and users to develop and promote highly sustainable construction practices. It is important to note that a building does not have to be certified to be sustainable and well-built.

The guidelines within rating systems also help to clarify a market filled with "green" options. Rating systems also clearly outline what green standards need to be followed and what types of green products should be included in construction specifications.

Ultimately, the type of certification system pursued for a project depends upon that singular project; none of these certification systems are one-size-fits all. The dynamic nature of projects might prohibit one system but favor another. The choice is dependent upon the uniqueness of each project and the project needs and requirements such as the project location, size, budget, and overall project goals. Also comparing essential issues such as cost, ease of use, and building performance will help determine which building rating system is applicable and which certification level is possible.

Building rating and certification systems are in a state of change and evolution and continue to be refined to reflect new standards and goals for achieving ever higher levels of sustainability. So it is essential to investigate the most current versions of these programs to gain an understanding of particular requirements that must be met in order to achieve the best results.

BENEFITS OF USING GREEN BUILDING STANDARDS AND CERTIFICATION SYSTEMS

There are a wide range of economic and environmental benefits to sustainable design, often achieved through the use of standards, rating, and certification systems. According to a study of LEED certified buildings, the USGBC has found that energy, carbon, water, and waste can be reduced, resulting in savings of 30 to 97% respectively. Operating costs of green buildings can also be reduced by 8-9% while increasing in value up to 7.5%. Many sustainable buildings have also seen increases of up to 6.6% on return on investment, 3.5% increases in occupancy, and rent increases of 3%. Other benefits of green buildings, such as higher productivity and increased occupant health, have been attributed to better indoor environmental quality, increases in natural daylighting, and healthier materials and products within green buildings.

In a similar study by the GSA □, 12 sustainable buildings that were analyzed from a whole building perspective cost less to operate, have excellent energy performance, and have occupants that are more satisfied with the overall building than the occupants in typical commercial buildings. The 12 GSA buildings were compared to industry standard performance of energy, water, maintenance and operations, waste, recycling, transportation, and occupant satisfaction metrics.

While these benefits are possible, it is important to note that they are dependent upon factors such as climate, topography, timing, credit synergies, and local building standards.

SUMMARY OF GREEN BUILDING RATING AND CERTIFICATION SYSTEMS

The following table and the expanded information directly below it outlines several of the most commonly used and respected green building rating and certification systems in the marketplace.

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Energy Star	Single-Attribute	Government certification using a benchmarking method	U.S. EPA and U.S. DOE	Building energy and water use

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Leadership in Energy and Environmental Design (LEED)	Multi-Attribute	<p>Green building rating and certification system through independent third-party verification for:</p> <ul style="list-style-type: none"> • New Construction (NC) • Existing Buildings, Operations & Maintenance (EB O&M) • Commercial Interiors (CI) • Core & Shell (CS) • Schools (SCH) • Retail • Healthcare (HC) • Homes • Neighborhood Development (ND) 	U.S. Green Building Council	<p>Performance in:</p> <ul style="list-style-type: none"> • Sustainable Sites • Water Efficiency • Energy & Atmosphere • Materials & Resources • Indoor Environmental Quality • Locations & Linkages • Awareness & Education • Innovation in Design • Regional Priority through a set of prerequisites and credits
Green Globes	Multi-Attribute	<p>Green building guidance and assessment program for:</p> <ul style="list-style-type: none"> • Existing buildings • New construction 	Green Building Initiative in the U.S. BOMA Canada	<p>Environmental assessment areas to earn credits in:</p> <ul style="list-style-type: none"> • Energy • Indoor Environment • Site • Water • Resources • Emissions • Project/Environmental Management <p>No prerequisites</p>

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Living Building Challenge	Multi-Attribute	<p>Performance-based standard, and certification program for:</p> <ul style="list-style-type: none"> • Landscape and infrastructure projects • Partial renovations and complete building renewals • New building construction • Neighborhood, campus and community design 	International Living Future Institute	<p>Performance areas include:</p> <ul style="list-style-type: none"> • Site • Water • Energy • Materials • Health • Equity • Beauty <p>All areas are requirements.</p>
NZEB	Multi-Attribute	Certification program using the structure of the Living Building Challenge which can be applied to any building type.	International Living Future Institute	<p>One hundred percent of the project's energy needs must be supplied by on-site renewable energy on a net annual basis, without the use of on-site combustion. NZEB certified buildings must also meet the following requirements of the Living Building Challenge:</p> <ul style="list-style-type: none"> • the first half of Imperative One, Limits to Growth, dealing with appropriate siting of buildings • Imperative 19, Beauty and Spirit • Imperative 20, Inspiration and Education

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Passive House Institute US	Multi-Attribute	<p>Performance based passive building standard</p> <ul style="list-style-type: none"> • Third-party RESNET approved quality assurance/quality control • Earns U.S. DOE Zero Energy Ready Home status • Includes HERS rating 	Passive House Institute US	<p>Any type of building.</p> <p>New focus areas include:</p> <ul style="list-style-type: none"> • air tightness requirement • source energy limit • space conditioning criteria
SITES	Multi-Attribute	Third party verified rating system for development projects located on sites with or without buildings.	Administered by GBCI	<p>Performance criteria in the areas of:</p> <ul style="list-style-type: none"> • Water • Wildlife Habitat • Energy • Air Quality • Human Health • Outdoor recreation opportunities

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
WELL Building Standard	Multi-Attribute	<p>Performance based standard and certification program for</p> <ul style="list-style-type: none"> • New and Existing Buildings • New and Existing Interiors • Core and Shell Retail • Education Facilities • Restaurant • Commercial Kitchen • Multifamily Residential 	Administered by the International WELL Building Institute™ (IWBI)	Measures attributes of buildings that impact occupant health by looking at seven factors: Air, Water, Nourishment, Light, Fitness, Comfort, Mind

INTERNATIONAL PROGRAMS

BCA Green Mark Scheme (Singapore)	Multi-Attribute	Benchmarking scheme that aims to achieve a sustainable built environment by incorporating best practices in environmental design and construction, and the adoption of green building technologies.	Building and Construction Authority (BCA)	<p>Rates buildings according to five key criteria:</p> <ul style="list-style-type: none"> • Energy efficiency • Water efficiency • Environmental protection • Indoor environmental quality, and • Other green and innovative features that contribute to better building performance.
-----------------------------------	-----------------	---	---	--

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
Beam (Hong Kong)	Multi-Attribute	Comprehensive standard and supporting process covering all building types, including mixed use complexes, both new and existing to assess, improve, certify, and label the environmental performance of buildings	Business Environment Council	<p>Performance and assessment in:</p> <ul style="list-style-type: none"> • Site aspects • Material aspects • Water use • Energy use • Indoor environmental quality • Innovations and additions
BREEAM (UK, EU, EFTA member states, EU candidates, as well as the Persian Gulf)	Multi-Attribute	<p>Certification system is a multi-tiered process with pre-assessment, third-party consultant guidance through an assessment organization for:</p> <ul style="list-style-type: none"> • New Construction • Communities • In Use Buildings and • EcoHomes 	BRE Global	<p>Assessment uses recognized measures of performance, which are set against established benchmarks in:</p> <ul style="list-style-type: none"> • Energy and water use • Internal environment (health and well-being) • Pollution • Transport • Materials • Waste • Ecology and • Management processes
CASBEE (Japan)	Multi-Attribute	<p>Building assessment tools for</p> <ul style="list-style-type: none"> • Pre-design • New Construction • Existing Building and • Renovation 	JSBC (Japan Sustainable Building Consortium) and its affiliated sub-committees	<p>Assessment areas include:</p> <ul style="list-style-type: none"> • Energy efficiency • Resource efficiency • Local environment, and • Indoor environment

BUILDING RATING OR CERTIFICATION SYSTEM	SINGLE-OR MULTI-ATTRIBUTE	TYPE OF STANDARD OR CERTIFICATION	MANAGING ORGANIZATION	ISSUES / AREAS OF FOCUS
EDGE	Multi-Attribute	A universal standard and a certification system for residential and commercial structures.	International Finance Corporation (IFC), a member of the World Bank Group	Assessment areas include: <ul style="list-style-type: none"> • Energy • Water • Materials
Green Star SA (South Africa)	Multi-Attribute	Green building rating system for: <ul style="list-style-type: none"> • Office • Retail • Multi-unit residential 	Green Building Council of South Africa administers program Independent assessors to assess and score projects	Categories assessed in: <ul style="list-style-type: none"> • Management • Indoor Environmental Quality • Energy • Transport • Water • Materials • Land Use & Ecology • Emissions • Innovation
Pearl Rating System for Estidama (UAE)	Multi-Attribute	Green building rating system for: <ul style="list-style-type: none"> • Community • Buildings • Villas • Temporary Villas and Buildings 	Abu Dhabi Urban Planning Council	Assessment of performance in: <ul style="list-style-type: none"> • Integrated Development Process • Natural Systems • Livable Communities • Precious Water • Resourceful Energy • Stewarding Materials • Innovating Practice

SINGLE-ATTRIBUTE GREEN BUILDING RATING SYSTEMS



Energy Star Rating System—is a rating system created by the U.S. EPA and DOE that uses a benchmarking method to assess a building's energy and water use. (Please note that Energy Star also has a product certification program. (See also Single-Attribute Product Certification above.)

As stated on the ENERGY STAR website, "statistically representative models are used to compare your building against similar buildings from a national survey conducted by the Department of Energy's Energy Information Administration. This national survey, known as the *Commercial Building Energy*

Consumption Survey (CBECS), is conducted every four years, and gathers data on building characteristics and energy use from thousands of buildings across the United States. Your *building's peer group of comparison* are those buildings in the CBECS survey that have similar building and operating characteristics. A rating of 50 indicates that the building, from an energy consumption standpoint, performs better than 50% of all similar buildings nationwide, while a rating of 75 indicates that the building performs better than 75% of all similar buildings nationwide."

To receive an Energy Star rating, a project's energy usage must be tracked with the online [Portfolio Manager](#) and receive a score of 75 or more.

MULTI-ATTRIBUTE GREEN BUILDING RATING SYSTEMS

Outlined below are the building rating systems most commonly in use within the U.S. in the private and public sectors. Additionally, international programs are included to provide a reference point for those developing projects outside the U.S.



Leadership in Energy and Environmental Design (LEED)—was created in 2000 by the [U.S. Green Building Council](#) (USGBC), for rating design and construction practices that would define a green building in the United States. LEED is used throughout North America as well as in more than 30 countries with over 6,300 projects currently certified across the globe and over 21,000 projects registered. As of September 2010, over [35 state governments, 380 cities and towns, and 58 counties](#) have enacted sustainable legislation, ordinances, or policies, many of which specifically call for LEED certification.

LEED consists of credits which earn points in 7 categories: *Site Selection, Water Efficiency, Energy and Atmosphere, Materials and Resources, Indoor Environmental Quality, Regional Priority, and Innovation in Design*. One hundred points are available across these categories with mandatory prerequisites such as minimum energy and water-use reduction, recycling collection, and tobacco smoke control. Within each category are credits that pertain to specific strategies for sustainability, such as the use of low-emitting products, reduced [water consumption, energy efficiency](#), access to public transportation, [recycled content, renewable energy](#), and [daylighting](#). Since its inception, LEED standards have become more stringent as the market has changed and expanded to include [distinct rating systems](#) that address different building types: New Construction, Existing Buildings, Commercial Interiors, Core & Shell, Schools, Retail, Healthcare, Homes, and Neighborhood Development.

The LEED certification process takes place at [LEED Online](#). Project teams are required to compile documentation to show compliance with LEED requirements and upload this documentation to the LEED Online website. The documentation is then reviewed by the Green Building Certification Institute (GBCI); a LEED certification is earned if all prerequisites and a sufficient number of credits are earned. There are four levels of LEED certification: Certified, Silver, Gold, and Platinum. There are no on-site visits required and certification can occur upon completion of construction.

The Green Globes logo features a stylized 'G' composed of three overlapping circles in green, yellow, and blue. To the right of the logo, the words "GREEN GLOBES" are written in a bold, sans-serif font, with "GREEN" in green and "GLOBES" in yellow.

Buildings are rated on a 1,000 point scale spread across seven categories: *Energy, Indoor Environment, Site, Water, Resources, Emissions, and Project/Environmental Management*. Users can indicate that certain credits may not be applicable to a project, a feature unique to Green Globes. It also does not have prerequisites. A [Green Globes rating](#) requires a Green Globes Assessor to perform an onsite assessment of the building. This ensures

that the self-reported claims made in the online documentation are verified. Both new construction and existing buildings can be evaluated using Green Globes; commercial or multifamily.

The first step toward a Green Globes certification is completing a self-reported online assessment survey, which is required at various stages throughout design and construction. At the construction documents phase and after substantial completion, a Green Globes Assessor will perform a site visit to verify the claims made in the survey. A [Green Globes](#) certification of one through four globes can then be earned once verification is confirmed.



[Living Building Challenge \(LBC\)](#)—is a performance-based system initially launched by the Cascadia Green Building Council. In April 2011, the International Living Future Institute became the umbrella organization for both the Cascadia Green Building Council and the Living Building Challenge.

The LBC makes stringent demands such as 100% [net zero energy](#), 100% net zero water, on-site renewable energy, and 100% recycling or diversion of construction waste. It examines site, water, energy, materials, health, equity, and beauty. All of its tenets are mandatory making it the most rigorous green building certification system in the market today. An on-site audit must occur by a member of the [International Living Future Institute \(ILFI\)](#)

After online registration, projects must join the living building community where discussions concerning compliance are held, and documentation occurs. Certification occurs twelve months after project completion, with an on-site audit to ensure compliance.

[NZEB](#)—The International Living Future Institute (ILFI) provides a certification option for a Net Zero Energy Building (NZEB) under its umbrella of the Living Building Challenge certification. These buildings have 100% of their energy needs supplied by on-site renewable energy on a net annual basis. The NZEB designation verifies that a building is truly operating as claimed, harnessing energy from the sun, wind, or earth to exceed net annual demand. To earn this certification, a building must meet five requirements of the LBC:

- Limits of Growth
- Net Zero Energy
- Rights to Nature
- Beauty and Spirit
- Inspiration and Education.

According to ILFI, nearly any building can become NZEB-certified: new or operational, anywhere in the world.



Passive House Institute US

[Passive House Institute US \(PHIUS\)](#)—administers a climate-specific passive building standard and certification system that was developed under a DOE/Building America grant specifically to address complex US climates. Buildings designed and built to the PHIUS+ 2015 Passive Building Standard consume 86% less energy for heating and 46% less energy for cooling (depending on climate zone and building type) when compared to a code-compliant building.

PHIUS+ 2015 is the first and only passive building standard based upon climate-specific comfort and performance criteria aimed at presenting a cost-optimized solution to achieving the most durable, resilient, and energy-efficient building possible for a specific location. The PHIUS+2015 Passive Building Standard is applicable internationally. There are certified projects in South Korea and Japan, and projects are certifying most recently in China and Israel. In North America, PHIUS is the leading educational institute with most certified passive building professionals trained in North America. PHIUS is also the leading certifier of passive houses and buildings with 95% of all passive construction currently underway. The German Institute is also active in the US and has certified under their program to date about 5% of all passive building construction.

SITES—Administered by Green Business Certification Inc. (GBCI), the Sustainable Sites Initiative (SITES) offers a comprehensive rating system designed to distinguish sustainable landscapes, measure their performance and elevate their value. SITES certification is for development projects located on sites with or without buildings—ranging from national parks to corporate campuses, streetscapes to homes, and more. SITES is used by landscape architects, designers, engineers, architects, developers, policy-makers and others to align land development and management with innovative sustainable design. Land is a crucial component of the built environment and can be planned, designed, developed and maintained to protect and enhance the benefits we derive from healthy functioning landscapes. SITES helps create ecologically resilient communities and benefits the environment, property owners, and local and regional communities and economies.

WELL—is a performance-based system for measuring, certifying, and monitoring features of the built environment that impact human health and well-being by looking at seven factors, or Concepts. They include: *Air, Water, Nourishment, Light, Fitness, Comfort, and Mind*.

WELL is grounded in a body of medical research that explores the connection between the buildings where people spend more than 90 percent of their time, and the health and wellness impacts on occupants. WELL Certified spaces and WELL Core and Shell Compliant developments can help create a built environment that improves the nutrition, fitness, mood, sleep patterns and performance of its occupants. WELL is composed of over 100 Features that are applied to each building project, and each WELL feature is designed to address issues that impact the health, comfort, or knowledge of occupants. Many WELL Features intended to improve health are supported by existing government standards or other standards-setting organizations. WELL Features are categorized as either *Preconditions*—necessary for baseline WELL Certification or Compliance, or *Optimizations*—optional enhancements, which together determine the level of certification above baseline certification. The Features of WELL can be applied across many real estate sectors, and the current WELL v1 is optimized for commercial and institutional office buildings. WELL is further organized into Project Typologies which take into account the specific set of considerations that are unique to a particular building type or phase of construction. For WELL v1, three project typologies are: New and Existing Buildings, New and Existing Interiors, and Core and Shell.

INTERNATIONAL GREEN BUILDING RATING SYSTEMS

There are many international green building design systems that also set up their criteria through a nationalistic focus, keeping local standards and codes in mind. They include:

BCA Green Mark Scheme—Based in Singapore, Green Mark was launched by the Building and Construction Authority (BCA) in January 2005 to promote environmental awareness in the construction and real estate sectors. The BCA Green Mark Scheme rates buildings according to five key criteria including: energy efficiency, water efficiency, environmental protection, indoor environmental quality, and other green and innovative features that contribute to better building performance. The program outlines a six step scheme that also offers cash incentives to developers, especially focused on addressing improvements to existing construction in areas such as energy use reduction and materials conservation.

BEAM—Based in Hong Kong, BEAM is a comprehensive standard and supporting process covering all building types, including existing and newly constructed mixed use complexes. BEAM is an initiative that assesses, improves, certifies, and labels the environmental performance of buildings. It is a voluntary program developed in partnership with, and adopted by the industry. BEAM is intended to: stimulate demand for more sustainable buildings in Hong Kong and other regions, giving recognition for improved performance and minimizing false claims; provide a common set of performance standards that can be pursued by developers, designers, architects, engineers, contractors and operators; reduce the environmental impacts of buildings throughout the planning,

design, construction, management and demolition life cycle; and increase awareness in the building community, and ensure that environmental considerations are integrated at the beginning of a project.

BEAM assessments are currently undertaken by the Business Environment Council (BEC), an independent, nonprofit, environmental information center, under the guidance of the BEAM Society Executive Committee. Certification can only be issued upon building completion due to a significant number of credits being based on actions taken during construction and upon completion.

Building Research Establishment Environmental Assessment Method ([BREEAM](#))—has served as the basis for many of the green building certification systems. It was the first building rating system to be established and has been in use since 1990 throughout the UK, EU, EFTA member states, EU candidates, as well as the Persian Gulf. Due to its longevity, its use is widespread and its certification highly recognized. BREEAM ratings are required for many governmental organizations throughout these countries and there are currently over 100,000 BREEAM-rated buildings. BREEAM is a multi-attribute rating system that awards credits for categories such as management, energy, transport, material and waste, and pollution.

The BREEAM application and certification system is a multi-tiered process with pre-assessment, third-party consultant guidance through an assessment organization, of which there are over 1,000 in the UK alone, and the approval process. BREEAM has stipulated that projects must be certified within five years of registration.

[CASBEE](#)—in Japan is composed of four assessment tools corresponding to the building life cycle. "CASBEE Family" is the collective name for these four tools and the expanded tools for specific purposes. The CASBEE assessment tools are CASBEE for Pre-design, CASBEE for New Construction, CASBEE for Existing Building and CASBEE for Renovation, to serve at each stage of the design process. Each tool is intended for a separate purpose and target user, and is designed to accommodate a wide range of uses (offices, schools, apartments, etc.) in the evaluated buildings.

CASBEE covers the assessment fields of energy efficiency, resource efficiency, local environment, and indoor environment. Both indoor and outdoor spaces are considered as part of the assessment but are assessed separately.

[EDGE](#) (Excellence in Design for Greater Efficiencies)—is a green building certification system for new residential and commercial buildings in 125 emerging markets. The program, which engages financiers, developers, regulators, and homeowners, shows property developers how fast and affordable it is to construct resource-efficient buildings, enabling them to pass value directly to building owners and tenants. EDGE enables design teams and project owners to assess the most cost-effective ways to incorporate energy and water-saving options into their buildings. An innovation of the [International Finance Corporation \(IFC\)](#), a member of the [World Bank Group](#) that focuses on private sector development, EDGE consists of a web-based software application, a universal standard and a certification system.

[Green Star SA](#)—was developed by The Green Building Council of South Africa, and is based on the Australian Green Building Council tools to provide the property industry with an objective measurement for green buildings and to recognize and reward environmental leadership in the property industry. Each rating tool reflects a different market sector (office, retail, multi-unit residential, etc.). The objectives of the Green Star SA rating tools are to: establish a common language and standard of measurement for green buildings, promote integrated, whole building design, raise awareness of green building benefits, recognize environmental leadership, and reduce the environmental impact of development.

Green Star SA Certification is a formal process which involves a project using a Green Star SA rating tool to guide the design or construction process during which a documentation-based submission must be submitted as proof

of the achievement. A "Design" certification can be submitted for and awarded at the end of the design phase of the project. At the end of construction, a project can submit for and be awarded "As Built" certification, certifying that all green building strategies were in fact incorporated into the final building. The Certified Rating can be achieved prior to practical completion, but must be achieved no later than 24 months after practical completion. As Built submissions must be submitted after practical completion, and the Certified Rating must be achieved no later than 24 months after practical completion.

Pearl Rating System for Estidama—Estidama, which means 'sustainability' in Arabic, is intended to be the initiative which will transform Abu Dhabi into a model of sustainable urbanization. Its aim is to create more sustainable communities, cities, and global enterprises and to balance the four pillars of Estidama: environmental, economic, cultural, and social. The Pearl Rating System for Estidama aims to address the sustainability of a given development throughout its life cycle from design through construction to operation. Accordingly, three rating stages have been established: Design, Construction, and Operational.

Within each section there are both mandatory and optional credits and credit points are awarded for each optional credit achieved. To achieve a 1 Pearl rating, all the mandatory credit requirements must be met. To achieve a higher Pearl rating, all the mandatory credit requirements must be met along with a minimum number of credit points.

EMERGING ISSUES

New green technologies and materials are always being developed and entering into the marketplace to complement current practices in creating greener environments. Many of these technologies and materials have not been tested long enough in the built environment in order to fully verify their performance. Seek extensive testing and performance data before incorporating new technologies and materials into a project. Also, test beyond the product's green performance for safety, durability, and fire resistance standards from [UL](#) and [ETL](#).

New and more stringent requirements will continue to be introduced to the standards and certifications process. Because of the toxicity of some pesticides and fire retardants, and additional means of exposure, testing and certifying beyond product emissions to product content is a trend that will likely increase.

Over the last several years there has also been a shift away from a prescriptive approach to sustainable design toward the scientific evaluation of actual performance through Life Cycle Assessments (LCA). While LCAs are not yet a consistent requirement of green building rating systems and codes, there is a trend toward requiring LCAs and improving the methods for conducting them.

RELEVANT CODES AND STANDARDS

FEDERAL MANDATES, ACTS, AND EXECUTIVE ORDERS

- Energy Independence and Security Act of 2007
- Executive Order 13693, "Planning for Federal Sustainability in the Next Decade"
- Energy Policy Act of 2005 (EPACT)

INTERNATIONAL CODE COUNCIL

- International Green Construction Code (IgCC). The IgCC is intended to be used as a jurisdictional and municipal building code for new construction and major renovations. The IgCC is a comprehensive code document; it sets standards for energy conservation, water efficiency, and commissioning, and also includes enforcement procedures and guidelines for existing building renovations.
- **ICC 700 National Green Building Standard**. The standard defines green building for single-family and multi-family homes, residential remodeling, and site development projects while allowing enough flexibility to incorporate regionally appropriate best green practices.

ASHRAE STANDARDS

- ANSI/ASHRAE/USGBC/IES Standard 189.1, *Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings* this standard provides minimum requirements for site, design, construction and operations in mandatory, code-enforceable language. A collaborative effort by ASHRAE, IES and USGBC, this standard is comprehensive and includes chapters for site, water, energy efficiency, indoor environmental quality, and materials. ASHRAE 189.1 can be used as a jurisdictional compliance path for the IgCC.
- ASHRAE Standard 55, *Thermal Environmental Conditions for Human Occupancy*
- ASHRAE Standard 62.1, *Ventilation for Acceptable Indoor Air Quality*
- ASHRAE Standard 90.1, *Energy Standard for Buildings Except Low-Rise Residential Buildings*

WATER-RELATED LEGISLATION AND CODES

- Energy Independence and Security Act (EISA) Section 438 (stormwater)
- Energy Policy Act of 1992
- Energy Policy Act of 2005 (EPACT) Section 109 (process water)
- *International Plumbing Code (IPC)*, (ICC)
- Uniform Plumbing Code 2006, (IAMPO)

MATERIAL-RELATED LEGISLATION

- Farm Security and Rural Investment Act of 2002 (FSRIA)
- Resource Conservation and Recovery Act (RCRA)

MUNICIPAL STANDARDS

Many cities, states, and U.S. Territories have also implemented green standards for public buildings. Every city's, state's, and U.S. Territory's energy goals and requirements are listed, highlighting LEED, Green Globes, and carbon emission reduction goals. New York City and California are two examples of governments that have implemented green standards for public buildings.

CALIFORNIA

California has implemented green building standards for all major renovations and new construction of public buildings. **Executive Order S-3-05** calls to reduce greenhouse gas emissions 80% below 1990 levels by 2050. To accomplish this goal, **Executive Order S-20-04** requires all state buildings to reduce energy usage by 20% and achieve a minimum of a Silver LEED rating.

- Assembly Bill 32: California Global Warming Solutions Act

- California Green Building Strategy
- California Executive Order S-3-05
- CalGREEN code □

NEW YORK CITY

New York City's [Local Law 86](#) requires LEED certification for public buildings with construction costs exceeding \$2 million. The [NYC Greener, Greater Buildings Plan](#) is another example of NYC's commitment to sustainability. It requires a combination of benchmarking, energy audits, retro-commissioning, lighting upgrades and sub-metering for the city's largest buildings.

- New York City's Greener Greater Buildings Plan—Local Laws 84, 85, 87, 88
- New York City's Local Law 86 Diagram of Criteria and Requirements □
- New York City Mayor's Office of Environment Coordination

ADDITIONAL RESOURCES

WBDG

BUILDING TYPES / SPACE TYPES

Applicable to all [Building Types](#) and [Space Types](#)

DESIGN OBJECTIVES

Aesthetics, Cost-Effective, Sustainable

GUIDES & SPECIFICATIONS

BUILDING ENVELOPE DESIGN GUIDE

[Sustainability of the Building Envelope](#)

BUILDING COMMISSIONING

[Building Commissioning](#)

ORGANIZATIONS

- BioPreferred (USDA)
- Crosswalk of Sustainability Goals and Targets in Executive Orders and Statutes by DOE and FEMP □
- Energy Star's Portfolio Manager
- Pharos Project
- WaterSense
 - WaterSense Product Database
 - WaterSense Rebate Finder

PUBLICATIONS

- A comparative study of building energy performance assessment between LEED, BREEAM, and Green Star Schemes" □ by Roderick, Y et al. Integrated Environmental Solutions Limited, Kelvin Campus, West of Scotland Science Park, Glasgow, G20 0SP, U.K.
- *Guide to Green Building Rating Systems: Understanding LEED, Green Globes, Energy Star, the National Green Building Standard, and More* by Reeder, L. Hoboken, NJ: John Wiley & Sons, Inc., 2010.
- *Sustainable Building Rating Systems Summary* by K.M. Fowler and E.M. Rauch. Completed by the Pacific Northwest National Laboratory, July 2006.



LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name:

Date:

Y	?	N	Credit	Integrative Process
---	---	---	--------	---------------------

1

0	0	0	Location and Transportation	16
			Credit LEED for Neighborhood Development Location	16
			Credit Sensitive Land Protection	1
			Credit High Priority Site	2
			Credit Surrounding Density and Diverse Uses	5
			Credit Access to Quality Transit	5
			Credit Bicycle Facilities	1
			Credit Reduced Parking Footprint	1
			Credit Green Vehicles	1

0	0	0	Materials and Resources	13
			Prereq Storage and Collection of Recyclables	Required
			Prereq Construction and Demolition Waste Management Planning	Required
			Credit Building Life-Cycle Impact Reduction	5
			Credit Building Product Disclosure and Optimization - Environmental Product Declarations	2
			Credit Building Product Disclosure and Optimization - Sourcing of Raw Materials	2
			Credit Building Product Disclosure and Optimization - Material Ingredients	2
			Credit Construction and Demolition Waste Management	2

0	0	0	Sustainable Sites	10
			Prereq Construction Activity Pollution Prevention	Required
			Credit Site Assessment	1
			Credit Site Development - Protect or Restore Habitat	2
			Credit Open Space	1
			Credit Rainwater Management	3
			Credit Heat Island Reduction	2
			Credit Light Pollution Reduction	1

0	0	0	Indoor Environmental Quality	16
			Prereq Minimum Indoor Air Quality Performance	Required
			Prereq Environmental Tobacco Smoke Control	Required
			Credit Enhanced Indoor Air Quality Strategies	2
			Credit Low-Emitting Materials	3
			Credit Construction Indoor Air Quality Management Plan	1
			Credit Indoor Air Quality Assessment	2
			Credit Thermal Comfort	1
			Credit Interior Lighting	2
			Credit Daylight	3
			Credit Quality Views	1
			Credit Acoustic Performance	1

0	0	0	Water Efficiency	11
			Prereq Outdoor Water Use Reduction	Required
			Prereq Indoor Water Use Reduction	Required
			Prereq Building-Level Water Metering	Required
			Credit Outdoor Water Use Reduction	2
			Credit Indoor Water Use Reduction	6
			Credit Cooling Tower Water Use	2
			Credit Water Metering	1

0	0	0	Innovation	6
			Credit Innovation	5
			Credit LEED Accredited Professional	1

0	0	0	Energy and Atmosphere	33
			Prereq Fundamental Commissioning and Verification	Required
			Prereq Minimum Energy Performance	Required
			Prereq Building-Level Energy Metering	Required
			Prereq Fundamental Refrigerant Management	Required
			Credit Enhanced Commissioning	6
			Credit Optimize Energy Performance	18
			Credit Advanced Energy Metering	1
			Credit Demand Response	2
			Credit Renewable Energy Production	3
			Credit Enhanced Refrigerant Management	1
			Credit Green Power and Carbon Offsets	2

0	0	0	TOTALS	Possible Points: 110
---	---	---	--------	----------------------

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110



LEED v4 for Building Design and Construction: Multifamily Midrise

Project Checklist

Project Name:
Date:

Y ? N
 Credit Integrative Process

2

0 0 0 Location and Transportation			15
Y	Prereq	Floodplain Avoidance	Required
PERFORMANCE PATH			
		Credit LEED for Neighborhood Development Location	15
PRESCRIPTIVE PATH			
		Credit Site Selection	8
		Credit Compact Development	3
		Credit Community Resources	2
		Credit Access to Transit	2

0 0 0 Sustainable Sites			7
Y	Prereq	Construction Activity Pollution Prevention	Required
Y	Prereq	No Invasive Plants	Required
		Credit Heat Island Reduction	2
		Credit Rainwater Management	3
		Credit Non-Toxic Pest Control	2

0 0 0 Water Efficiency			12
Y	Prereq	Water Metering	Required
PERFORMANCE PATH			
		Credit Total Water Use	12
PRESCRIPTIVE PATH			
		Credit Indoor Water Use	6
		Credit Outdoor Water Use	4

0 0 0 Energy and Atmosphere			37
Y	Prereq	Minimum Energy Performance	Required
Y	Prereq	Energy Metering	Required
Y	Prereq	Education of the Homeowner, Tenant or Building Manager	Required
		Credit Annual Energy Use	30
		Credit Efficient Hot Water Distribution	5
		Credit Advanced Utility Tracking	2

0 0 0 Materials and Resources			9
Y	Prereq	Certified Tropical Wood	Required
Y	Prereq	Durability Management	Required
		Durability Management Verification	1
		Credit Environmentally Preferable Products	5
		Credit Construction Waste Management	3

0 0 0 Indoor Environmental Quality			18
Y	Prereq	Ventilation	Required
Y	Prereq	Combustion Venting	Required
Y	Prereq	Garage Pollutant Protection	Required
Y	Prereq	Radon-Resistant Construction	Required
Y	Prereq	Air Filtering	Required
Y	Prereq	Environmental Tobacco Smoke	Required
Y	Prereq	Compartmentalization	Required
		Credit Enhanced Ventilation	3
		Credit Contaminant Control	2
		Credit Balancing of Heating and Cooling Distribution Systems	3
		Credit Enhanced Compartmentalization	3
		Credit Enhanced Combustion Venting	2
		Credit Enhanced Garage Pollutant Protection	1
		Credit Low Emitting Products	3
		Credit No Environmental Tobacco Smoke	1

0 0 0 Innovation			6
Y	Prereq	Preliminary Rating	Required
		Credit Innovation	5
		Credit LEED AP Homes	1

0 0 0 Regional Priority			4
		Credit Regional Priority: Specific Credit	1
		Credit Regional Priority: Specific Credit	1
		Credit Regional Priority: Specific Credit	1
		Credit Regional Priority: Specific Credit	1

0 | 0 | 0 TOTALS Possible Points: 110
 Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

Comparing Green Globes & LEED

Program Features	Green Globes	LEED
Uses ANSI Approved Consensus Development Process	YES	NO
Nationally Accepted Program	YES	YES
Program Delivery	Online, interactive survey	Online submission of forms
1-on-1 Customer Support - Learn More	YES	NO
New Construction Assessment	YES	YES
Existing Building Assessment	YES	YES
Total Program Points	1,000	110
Minimum Points Required for Certification	YES	YES
Weighted Criteria & Partial Credit - Learn more	YES	LIMITED
Program Prerequisites - Learn more	NO	YES
Flexibility for Non-Applicable Criteria - Learn more	YES	NO
Energy Performance (New Construction) Learn more	Benchmarks against actual regional performance data	Benchmarks against hypothetical building model
Incorporates Life Cycle Assessment (LCA) Learn more	YES	NO
Forest Certifications Accepted	4	1
Sustainability Recommendations w/Automated Report	YES	NO
Certification Process	Preliminary online evaluation followed by third-party on-site assessment	Complete & submit assessment form, wait for results
Certification Rating System	4 Globes 3 Globes 2 Globes 1 Globe	LEED Platinum LEED Gold LEED Silver Certified LEED
Certified Personnel Training Program	YES	YES
Time to Complete Documentation	⌚	⌚⌚⌚⌚
Cost to Certify a Typical Building >100,000 sq ft	\$	\$\$\$

For more details, please visit us online at <http://www.thegbi.org>.

Green Globes® for New Construction

Better Building Science for Better Results

Prepared by:
Donald Martin, AIA, NCARB, LEED AP, GGP
MARSTON design studio



Stevan Vinci, CET, LEED AP BD+C, LEED AP O+M, GGP
Morrison Hershfield Corporation



Dan Prows, LEED AP, CSDP
Morrison Hershfield Corporation



May 2013

Introduction

In today's economy, owners and design professionals are looking to design and construct projects that are environmentally friendly and within budget. Sustainable design or green design has gained significant strength in the last 10 years and is a widely employed element for design and construction professionals. Programs to support green building assessment and certification are now undergoing significant changes. Due to a recent major program update, Green Globes now uses the most advanced building science to support the design and construction of sustainable buildings that can also deliver significantly reduced operating costs.

Why Sustainable Design and Construction?

There are many distinctive and substantial benefits to building sustainable buildings due to the integration of economic, environmental and social goals.

The economic advantages of building sustainable buildings include reduced life cycle operating costs, reduced water consumption, reduced insurance rates, productivity gains, improved image and increased property values.

Ecological benefits are broad and wide reaching, from protecting natural spaces and enhancing existing ecology to reducing water/energy/material use. These measures directly and indirectly result in reductions to greenhouse gas emissions, ecological footprint, climate change impact, natural resource consumption, and strain on infrastructure.

There are also substantial social benefits, including increased occupant comfort and health, increased natural light, the promotion of mass transit, and urban densification.

As you can see, there is a strong business case for green building in the United States when a holistic, long-term view of the benefits and real building costs are considered.

Green Building Rating Systems

There are four green building rating systems at the pinnacle of sustainable design and construction: Green Globes, LEED™, ENERGY STAR® and ASHRAE Building Energy Quotient (bEQ).

The design and construction industry is familiar with the LEED certification systems and the bureaucracy that engulfs the certification process within the USGBC. The latest version of LEED, LEED v4, appears to have even more changes in the green building certification process, possibly making it even more difficult and complicated.

People outside of the design and construction industry are most familiar with the ENERGY STAR logo that can be seen on laptops and home appliances. The ENERGY STAR program certifies a building based on Energy Use Intensities (EUIs) and rates the project on a scale of 1-100. The performance information used to rate the project is based on information received from the US Energy Information Agency's Commercial Building Energy Survey (CBECS) collected by the EPA. A project team can utilize the ENERGY STAR program to

achieve energy performance points in the Green Globes for New Construction certification program.

The ASHRAE Building Energy Quotient is a new certification program that measures both as-designed and in-operation energy performance. ASHRAE bEQ derives its usage and intensity baselines from the ENERGY STAR Target Finder™ Tool (Ravi Srinivasan, 2013) and is one of the four paths a design team can utilize to achieve energy performance points in the Green Globes for New Construction certification program.

The Green Building Rating System at the forefront of sustainable design is Green Globes. Its overall “ease of use, system flexibility, adaptability and transparency” separate Green Globes from LEED as a distinct and effective certification system (Charles J. Kibert, 2012). The overall spirit and intent of sustainable design are most clearly represented within Green Globes. Buildings are essentially a “business” and, as with all sustainable building projects, any sustainable approach/path/technology must make sense and be reasonable to the business community or it will more than likely be rejected.

Green Globes for New Construction

Green Globes traces its origins to the United Kingdom and the BREEAM program (Building Research Establishment Environmental Assessment Method) as one of the first systems to environmentally assess buildings and to rate existing buildings. It helped set the standard for green building and measuring a building’s environmental performance.

The Green Globes certification program is available in the U.S through the Green Building Initiative (GBI). In 2005, the GBI became the first green building organization accredited as a standards developer through the American National Standards Institute (ANSI). The GBI developed the ANSI/GBI 01-2010: Green Building Assessment Protocol for Commercial Buildings and used it as the basis for the latest enhancements to the Green Globes for New Construction protocol.

Green Globes for New Construction is part of an integrated design process. It utilizes an online building assessment tool for each design phase from pre-design to construction documents. A third-party assessor is assigned to the project to review the online assessment and construction documents and then perform an on-site inspection. The process is user-friendly, and having an assigned assessor to contact regarding decisions and certification requirements ensures it is transparent and interactive. The GBI also has Green Globes certification programs for existing buildings (called Continual Improvement of Existing Buildings, or CIEB) and CIEB for Healthcare.

Recent enhancements to the Green Globes for New Construction assessment and certification protocol include Building Energy Performance Options and Life Cycle Assessment. These and other updates were made to make sustainability assessments more comprehensive and to give the design team more options to achieve sustainability goals. This concept of flexibility is the spirit of sustainability embodied in Green Globes. It encourages the design team to create higher performing buildings for their clients by allowing more than one path to achieve the owner’s sustainability goals. It is the opposite of a “one size fits all” approach and results in more building types being recognized for the sustainable measures employed.

Criteria Incorporates Advanced Building Science

The Green Globes certification process has seven environmental assessment areas: management, site, energy, water, materials & resources, emissions, and indoor environment. The energy, materials & resources, and water assessment areas are what separate Green Globes for New Construction from other green certification programs.

Environmental Assessment Areas



FIGURE 1-GREEN GLOBES ENVIRONMENTAL ASSESSMENT AREAS

Energy

The building industry is full of requirements related to energy efficiency, most of which mandate achieving specific reductions in energy use. The latest version of Green Globes for New Construction offers project teams and building stakeholders several options when it comes to assessing and implementing energy performance/efficiency into the design. Up to four paths, each of which has its own specific requirements and point limits, are available in order to achieve points in the Energy Performance section. Each path is proven to assist building stakeholders in decreasing building energy use. These paths are as follows:

Path A: ENERGY STAR Target Finder

Path B: ASHRAE 90.1-2010

Path C: ANSI/GBI 01-2010 Energy Performance Building Carbon Dioxide Equivalent Emissions (CO₂e)

Path D: ASHRAE Building Energy Quotient (bEQ)

Path A: The ENERGY STAR Target Finder offers performance ratings based on Energy Use Intensity, which is extrapolated from actual performance data from related building types and related energy performance. The median building is modeled using data from US

Energy Information Agency's Commercial Building Energy Consumption Survey (CBECS) 2003. If your project meets the requirements of the eligible building types that can be entered into the ENERGY STAR Target Finder, this would be the most straightforward approach as compared to the other paths. If your project is not one of the eligible building types, then one of the other three paths should be pursued.

Path B: ASHRAE 90.1-2010 is the path most pursued with LEED projects. It models a baseline building based on the characteristics in ASHRAE 90.1-2010, Appendix G, with a proposed design using the same methodology from Appendix G. The energy performance is measured in the form of energy cost reduction.

Path C: Buildings account for 35% of all Green House Gas (GHG) emissions in North America. The building industry is being called upon not only to reduce energy consumption costs but to help fight climate change by achieving ambitious reduction targets for GHG emissions. The ANSI/GBI 01-2010 Energy Performance Building CO₂e performance path offers teams a way to quantify their reduction in CO₂e as the energy performance metric is provided in CO₂ equivalent emissions. Reducing GHG comes not only from energy efficient design and optimizing the building's energy demand, but also from utilizing low-carbon energy sources with clean/renewable energy generation. One advantage of this energy path is that the baseline building is determined by ENERGY STAR Target Finder, so the energy modeler and design team can spend their efforts on modeling the proposed building as accurately as possible and looking at real energy performance measures instead of spending effort on trying to make the baseline building worse. By comparing to an actual EUI, building stakeholders can look at things in absolute terms rather than using a "better than baseline" based on a fictitious reference.

Path D: The ASHRAE Building Energy Quotient rating program provides rating levels from B (Efficient) to A+ (Net Zero Energy). Similar to ENERGY STAR Target Finder, it utilizes information from CBECS (2003) data for the baseline building. The proposed design is modeled using ASHRAE 90.1-2007 and the energy performance is measured as a reduction in EUI.

The Green Globes for New Construction certification program offers the design team the four energy performance paths described above. This allows the project flexibility to show energy performance on various platforms, from the most familiar (ENERGY STAR) to the most cutting edge (ANSI and bEQ). This flexibility is unique to Green Globes and allows the energy modeler to provide information that helps the designers make informed decisions. In addition, extra credit points are available to project teams who show exemplary performance using Path C or Path D. Green Globes' flexible approach to energy performance provides building stakeholders with the means to achieve a balanced end product that is project specific and more energy efficient.

Similar to the notion that no single energy simulation software can accurately model all building and systems types accurately (i.e. EnergyPlus may model displacement ventilation more accurately than eQuest), no single energy performance path can suit all building types and project specific requirements.

Materials and Resources

The building industry Life Cycle Assessment (LCA) is included in the Green Globes for New Construction certification protocol as a quantifiable measurement of sustainability. Life cycle assessment is an emerging trend in green building design and is not directly addressed by LEED. LEED 2009 currently addresses LCA as a pilot credit that may be implemented in LEED v4. LEED 2009 will be available as a certification protocol through 2015 and is planned to run as a parallel certification track with LEED V4. LCA is critical to sustainability and is encouraged by Green Globes.

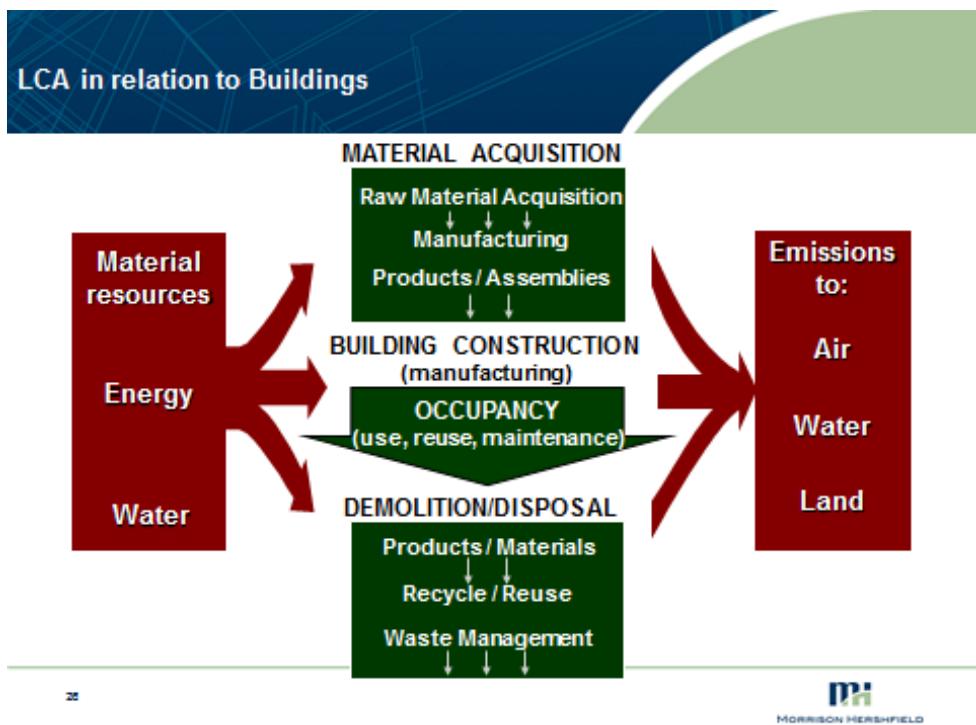


FIGURE 2-LIFE CYCLE DIAGRAM

The Materials & Product Selection section of Green Globes for New Construction is divided into two categories: Building Assembly and Interior Fit-Out. The building assembly includes the core, shell, and envelope whereas the interior fit-out includes all of the finishes and furnishings within the building assembly. Each category can be evaluated using either Path A: Performance Path or Path B: Prescriptive Path. This separation allows different approaches for product selection and evaluation and gives designers options for compliance.

Path A: Performance Path Green Globes for New Construction encourages use of the Athena Impact Estimator and/or other life cycle assessment tools for the Building Assembly and third-party peer reviewed life cycle assessments for the Interior Fit-out. The use of the Impact Estimator allows the design and construction teams to compare design scenarios and environmental considerations throughout the design process so that sustainable design decisions can be made prior to construction. The Impact Estimator is a “robust life cycle inventory of databases that provides accurate, scientific cradle-to-grave information for building materials and products, transportation, and construction and demolition

processes” (Institute, 2013). Life cycle assessment is a sustainable method for comparing building assemblies and their ability to meet project goals.

Path B: Prescriptive Path Currently, the most common method for sustainable product selection is the evaluation of “single attributes” (e.g. VOC’s, recycled content, bio-based, etc.), which is not ideal. To maximize sustainability, materials should be compared and selected based on multiple attributes. There are three such methods to evaluating products. The first is to use Type III Environmental Product Declarations (EPD’s), which are based upon recognized Product Category Rules and ISO Standards 14040, 14044, 14025 and 21930 or EN 15804. There are two classifications of Type III EPDS: Industry Wide EPDs, which are generic to a product type, and Product Specific Declarations, which are manufacturer-specific for a family of products. The second method is to utilize third-party material/product certifications that are based upon multiple attributes, such as NSF International assessment standards, UL Environment sustainability certifications, and sustainable forestry certifications. Multiple attribute standards should be consensus based and issued by an approved standards development organization. The third method is to utilize a third-party certified life cycle product assessment. Path B may be a better choice for interior fit-outs than Path A because “the multitude of different types of proprietary product formulations used for interior products” make it difficult to perform life cycle analysis of an interior fit-out (Jane M. Rohde, 2013). Ultimately, the goal is to select products that are environmentally responsible, durable and meet the functional and aesthetic needs of the client.

Water

Water consumption is an important factor to consider during project design and construction. Both the fixtures used and their installation play a role in how a building consumes and disposes of water. The GBI has created a water calculator that allows clients to gauge a building’s water performance by benchmarking it against a base building. This Excel-based water calculator offers the following features:

1. Input assumptions, such as building size and type, operating hours, and fixture use frequency
2. An output page that displays calculated baseline water use and allows the addition of other water consumption features, such as HVAC systems, pools, water features, commercial kitchens, etc.
3. Project use analysis, which includes water performance improvements over the baseline
4. A parallel program for multi-unit residential buildings

Water is an important resource, and water calculations play a key role in sustainable design and conservation. The GBI Water Calculator simplifies the water calculation process for building projects and is more accurate than other calculators due to its ability to accommodate additional water consumption fixtures.

Green Globes - The Process

Green Globes for New Construction is at the forefront of sustainability certification programs. Compared to LEED, Green Globes cuts out the bureaucracy, long review times, and complexity. Auden Schendler said it best in his essay "LEED is Broken, Let's Fix It": "We're concerned that LEED has become expensive, slow, confusing, and unwieldy, a death march for applicants administered by a soviet-style bureaucracy that makes green building more difficult than it needs to be. The result: mediocre 'green' buildings where certification, not environmental responsibility, is the primary goal" (Schendler, 2005).

Green Globes for New Construction is the answer for the frustrated LEED project team looking for an alternative green certification process. The excellent customer service, overall ease of use, transparency of the certification process, national recognition, and swift response times surpass LEED.

Any design team working on a sustainable project knows that documentation is of the utmost importance. During design and construction, questions arise and answers are needed in a timely manner to make decisions. Green Globes clients receive answers to those questions very quickly, usually within 1-2 days. Questions can be discussed with GBI staff or a third-party Green Globes Assessor so an informed decision can be made. This is where LEED fails and continues to get worse. LEED questions have to be submitted by email, and technical questions may have an associated cost. It often takes 2-4 weeks to receive a response to a LEED question, and sometimes they go unanswered. The GBI staff aids clients throughout the Green Globes certification process, and their customer service far surpasses that of any other green certification program.

Green Globes for New Construction consists of 6 phases.

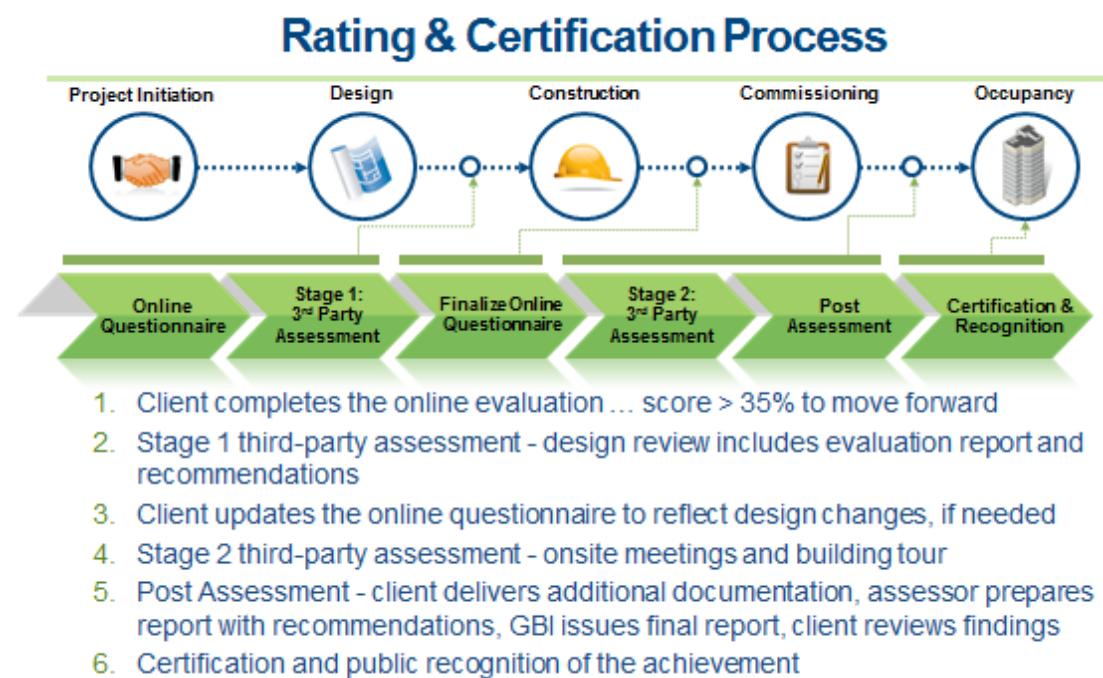


FIGURE 3-GBI RATING & CERTIFICATION PROCESS SUMMARY

Green Globes uses an online questionnaire to streamline the process and get to the overall intent of what sustainable design is all about. The online tool is easy to use, is compatible with any computer, and does not require special software for completion (LEED requires outdated Internet Explorer and Adobe Reader software). Once the questionnaire is complete, the NC Stage I Assessment can begin.

During the Stage I Assessment, a third-party assessor reviews the construction documents and compares them with the client's responses in the online questionnaire. The assessor then composes a Stage I report containing comments, recommendations, and a projected Green Globes score. The report provides the design team with helpful feedback on the current design, itemization of missing documentation, and suggestions to improve sustainability. The assessor is also available to answer any questions the client has about the report contents or projected Green Globes score. The dynamic interaction between the design team and assessor make the certification process easy, enjoyable, and successful.

When construction is essentially complete and the client makes any necessary updates to the online questionnaire, the third-party assessor can complete the Stage II On-Site Assessment. A member of the project team joins the assessor on-site to visually inspect the building and verify information submitted within the questionnaire and construction documents. The assessor may use his/her professional judgment to determine the level of compliance and points awarded. Unlike LEED, Green Globes allows partial points to be awarded if warranted. After the on-site assessment is complete and the client submits any missing documentation, the assessor writes a Stage II report that contains the evaluation results and recommended Green Globes rating. The GBI staff reviews the report and issues it to the client.

Overall, the Green Globes assessment process takes 30-45 days, compared to 120 days for LEED. This is a significant time difference and can be a critical decision factor when choosing a green certification program. A design team can lose a lot of time with LEED due to failed credit certification and poor response time from the USGBC. The GBI and Green Globes Assessor are dedicated to responding to client concerns quickly and with helpful information that keeps the review process moving forward. The intent of sustainable design is environmental awareness and support of long-term ecological balance, both of which are supported and promoted by Green Globes.

Conclusion

Green Globes for New Construction employs the best building science to deliver sustainable building certification. The certification process is streamlined by an online questionnaire and verified on-site by a 3rd party assessor. Green Globes projects benefit from reduced operating costs and provide real/tangible sustainability results while costing less for certification. Building owners often comment on the cumbersome LEED process, the high cost of certification, and the expense of required building features that do little to improve sustainability. The GBI believes that a client's return on investment in green building certification should outweigh its costs in both time and money spent.

The Green Building Initiative and the Green Globes for New Construction rating system represent the true intent of sustainable design. The GBI uses a proven process for the

certification and recognition of sustainable projects and continues to improve along with the design and construction industry. Green Globes is a competitive green building certification program that is at the forefront of building sustainability efforts.

Bios

Donald M. Martin, AIA, NCARB, LEED AP, GGP

Donald Martin has over 12 years of experience in architecture, planning, and consulting and is the Principal of MARSTON design studio. The past 12 years Donald has provided architectural design and consulting to sustainable construction and environmental design on multiple project types. Donald is a consulting Project Architect with Morrison Hershfield and is part of the sustainable services and building consultation team in Atlanta Georgia. Donald oversees the green certification of projects pursuing LEED, Green Globes, and ENERGY STAR. Donald's unique experience in the design and construction industry provides him a unique experience into environmental and sustainable design and the green certification process.

Stevan Vinci, CET, LEED AP BD+C, LEED AP O+M, GGP

Stevan serves as the Sustainability Practice Lead for Morrison Hershfield's Pacific Northwest offices and has provided green building consulting, building envelope/durability and commissioning duties on sustainability projects in Canada and in the US. Further to sustainability, Stevan has over 16 years of building science experience completing several building envelope assessments for building envelope failures as well as design assist services to architects on new construction projects. His experience also includes 3rd party building envelope drawing review, specification writing and construction drawing preparation of envelope systems. His experience in building envelope contributes to a better understanding of whole-building systems in his work in green buildings.

Dan Prows, LEED AP, CSDP

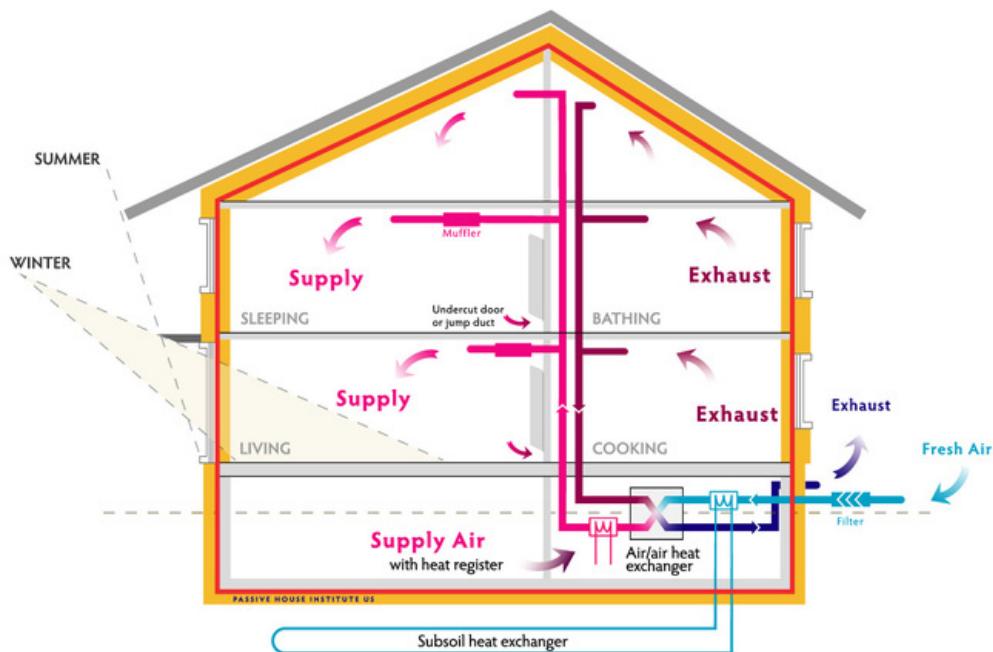
Dan Prows has over 14 years of experience in construction and business management, including 7 years dedicated solely to sustainable construction and environmentally conscious design. Dan brings with him vast experience in the building sciences of thermal envelope, HVAC, and alternative energy. Dan's work in the Northwest, Intermountain West, and Southeast United States provide him with unique experience to address challenges in multiple climate zones. He is currently Morrison Hershfield's U.S. Buildings Group's Director of Operations and is primarily responsible for the overall development, operation, and growth of sustainable services and building consultation. He teaches sustainable design and green construction methodology to architects, engineers, and construction personnel throughout the country.

-
- Charles J. Kibert, P. P. (2012). *Switching from LEED to Green Globes: A User's Perspective*.
- Initiative, G. B. (2010). *ANSI/GBI 01-2010 Green Building Assessment Protocol for Commercial Buildings*. Portland: Green Building Initiative, Inc.
- Initiative, G. B. (2013). *Green Globes for New Construction Technical Manual*. Portland: Green Building Initiative, Inc.
- Institute, A. S. (2013, April 25). *Impact Estimator*. Retrieved from Athena Sustainable Materials Institute: <http://www.athenasmi.org/our-software-data/impact-estimator/>
- Jane M. Rohde, A. F. (2013). *Materials and Resources White Paper*.
- Ravi Srinivasan, P. (2013). *Building Energy Performance Options of Green Globes NC. Overview of ENERGY STAR Target Finder, ASHRAE Std 90.1, ANSI/GBI 01-2010 and ASHRAE bEQ*.
- Schendler, A. (2005, October 27). *Top green-building system is in desperate need of repair*. Retrieved from grist, A Beacon in the Smog: <http://grist.org/article/leed/>

The Principles: Passive House Institute U.S.

Notebook: Planning Commission
Created: 12/10/2018 12:19 PM
URL: <http://www.phius.org/what-is-passive-building/passive-house-principles>

Passive House Principles



Passive building comprises a set of design principles used to attain a quantifiable and rigorous level of energy efficiency within a specific quantifiable comfort level. "Optimize your gains and losses" based on climate summarizes the approach. To that end, a passive building is designed and built in accordance with these five building-science principles:

- Employs continuous insulation throughout its entire envelope without any thermal bridging.
- The building envelope is extremely airtight, preventing infiltration of outside air and loss of conditioned air.
- Employs high-performance windows (double or triple-paned windows depending on climate and building type) and doors - solar gain is managed to exploit the sun's energy for heating purposes in the heating season and to minimize overheating during the cooling season.
- Uses some form of balanced heat- and moisture-recovery ventilation.
- Uses a minimal space conditioning system.

Passive building principles can be applied to all building typologies - from single-family homes to multifamily apartment buildings, offices, and skyscrapers.

Passive design strategy carefully models and balances a comprehensive set of factors including heat emissions from appliances and occupants to keep the building at comfortable and consistent indoor temperatures throughout the heating and cooling seasons. As a result, passive buildings offer tremendous long-term benefits in addition to energy efficiency:

- Superinsulation and airtight construction provide **unmatched comfort** even in extreme weather conditions.
- Continuous mechanical ventilation of fresh filtered air provides **superb indoor air quality**.
- A comprehensive systems approach to modeling, design, and construction produces **extremely resilient buildings**.
- Passive building principles offer the **best path to Net Zero and Net Positive** buildings by minimizing the load that renewables are required to provide.

The Performance Standard

North American building scientists and builders with funding from the U.S. Department of Energy (DOE) and the Canadian government were the first to pioneer passive building principles in the 1970s. In the late 1980s the German Passivhaus Institut (PHI) built on that research and those principles and developed a quantifiable performance standard that continues to work well in the Central European and similar climate zones.

However in practice, the [PHIUS Technical Committee](#), PHAUS members, and project teams building projects in North America learned that a single standard for all North American climate zones is unworkable. In some climates, meeting the standard is cost prohibitive, in other milder zones it's possible to hit the European standard while leaving substantial cost-effective energy savings unrealized.

As such, in cooperation with [Building Science Corporation](#) under a U.S. DOE Building America Grant, the PHIUS Technical Committee developed passive building standards that account for the broad range of climate conditions, market conditions, and other variables in North American climate zones. The result is the [PHIUS+ 2015 Passive Building Standard - North America](#), which was released in March of 2015. Regardless of the metric, the principles are the same, and the passive building community is working hard to make this approach the mainstream best practice for building design and construction.

Model Stretch Code Provisions

for a 20% Performance Improvement in New Commercial Construction

Correlated to ASHRAE 90.1-2013
and IECC 2015



nbi new buildings
institute

SUMMARY

Many U.S. cities and states have adopted meaningful goals to reduce carbon impacts and energy use, often aligned with the recent Paris Climate Accord. To achieve these goals, local governments are looking for tools and strategies to guide improvements in the energy performance of the building stock. Although energy codes have been a critical tool to drive efficiency improvements in the building sector, jurisdictions have realized that current energy codes are not delivering the level of building energy performance needed to meet energy and climate action goals. Stretch codes, or sometimes called “reach codes,” are meant to provide a series of additional building performance strategies that can be adopted by cities as more aggressive or incentivized stretch standards to drive improvements in the building sector.

The 20% Stretch Code Provisions measures are the first outcome of a larger project that is focused directly on the technical development of stretch codes and standards, and on support for jurisdictions in adopting and implementing these policies. The goal of this effort is to develop a series of stretch codes/provisions for both commercial and residential construction of increasing stringency that can be adopted by cities as policy or incentive programs to support progress toward energy or climate goals. As jurisdictions move forward with the adoption of codes and policies that support building stock performance improvement, a set of increasingly stringent performance metrics are anticipated, ranging from a 20% improvement over baseline code performance to a policy that delivers zero energy performance in buildings.

Benefits of Adopting a Stretch Code



- Adopting stretch codes offers a winning solution for cities, the building industry, and utilities.
- Adopting stretch codes puts cities and states on the path to achieving zero carbon emissions from the building sector.
- Adopting stretch codes reduces building energy use and costs, reduces overall load on the power system and helps cities meet carbon reduction goals.
- Cities and states can exercise flexibility and creativity in the way they adopt codes—via policy, voluntary programs, incentives and other methods.

A key characteristic of the 20% Stretch Code Provisions is that it is designed to be ‘adoptable’ as an energy code strategy. This means that the measures will align with current code scope and limitations, and primarily impact building components that are currently regulated by city building departments. It is also focused on prescriptive strategies, which is what most building departments and design projects are familiar with.

This documentation describes a set of code strategies that represent a 20% performance improvement for commercial buildings over the ASHRAE 90.1-2013 code baseline (and approximately similar savings over the IECC 2015 baseline). The 20% Stretch Code Provisions a set of individual building performance measures which can serve as an overlay on current code requirements to achieve improved energy performance. The savings of these strategies have been analyzed by the Pacific Northwest National Lab (PNNL) to demonstrate achievement of the 20% threshold on average across the building stock. Cities which control their own code destiny (meaning they can adopt energy codes at the city level) can use part or all of the measures in this set of stretch code provisions to increase code stringency or adopt a stretch code strategy with incentives. They can also be aligned with local utility incentive programs to drive higher compliance rates. For jurisdictions that are not able to adopt codes outside of a state process, the stretch code strategies could be used as part of a zoning policy or in conjunction with utility or other incentives.

Residential

For residential building performance, a 20% improvement is based on the Home Energy Rating System (HERS), under which discrete performance improvements can be targeted using lower HERS scores as the basis of improvement. Residential characteristics are described in a separate document that is being developed by New Building Institute (NBI).

Commercial

In collaboration with the PNNL, NBI has developed technical content and requirements in the form of adoptable stretch energy measures for commercial buildings that can deliver 20% energy savings beyond the most recently implemented model energy codes (IECC 2016 and ASHRAE Standard 90.1 2013).

The 20% Stretch Code Provisions development process included reviewing content from variety of other advanced code sources (ASHRAE Standard 189.1, International Green Construction Code and NYStretch-Energy) and current best building practices. This research was used to inform the measures selection process and content development.

Subsequent work will focus on strategies which achieve 40% improvement over base code, and policies to deliver zero energy building energy performance.

The 20% Stretch Code Provisions

To achieve savings of approximately 20% over the 90.1-2013 baseline, the following strategies are described that should be adopted into stretch code language.

Envelope Performance Improvements

Improvements in building envelope thermal performance reduce heating and cooling loads and improve occupant comfort. Envelope components tend to be among the longest lasting building elements, so it is important to invest in good building envelope performance. The required strategies include:

- Reduce energy losses through fenestration by increasing window assembly thermal performance (U-factor), reducing solar gain (SHGC), and managing overall window area. These performance improvements should not significantly reduce visible light transmittance through the glazing, to maintain daylighting performance and occupant views.
- Increase insulation levels in all opaque building envelope components. These improvements represent a slight increase in stringency over current code and can be achieved through standard building practices.
- Reduce heat transmission losses through uninsulated building elements. Thermal bridging occurs at uninsulated structural elements, like slab edges, window frames, and framing elements. When these components are uninsulated, the thermal performance of the overall building envelope is significantly degraded.
- Improve air barrier performance to reduce energy loss and moisture transmission through the building’s thermal envelopes. This strategy also requires testing and commissioning of the building air barrier at a time when improvements can be incorporated.

Lighting System Performance

- Reduce connected lighting load by deploying state-of-the-art solid state (LED) lamp technologies, and control systems that respond directly to the presence of occupants to insure that lights are only in use when needed by occupants.
- Increase the use of daylighting to offset electric lighting energy use.
- Reduce the lighting power for exterior spaces by requiring more efficient lamp and fixture technologies, and incorporate advanced controls which can reduce exterior lighting use when not needed.

Heating, Cooling, and Ventilation Systems

Continued efficiency improvements are possible in conventional mechanical systems, while significant efficiency gains are possible through better system configurations.

Adopt requirements for increased equipment efficiency, or select alternative mechanical systems with more efficient distribution strategies, particularly those that reduce or eliminate fan energy use.

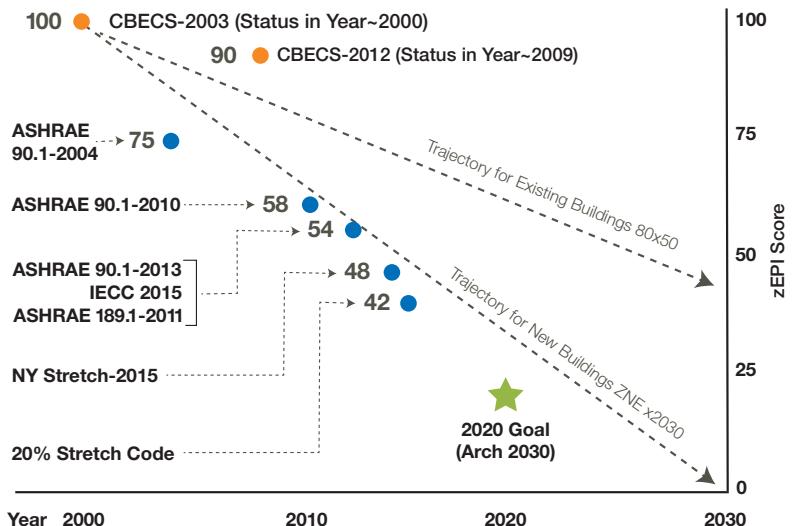
- Separate ventilation systems from heating and cooling systems, and incorporate heat recovery into ventilation systems.
- Improve the responsiveness of these systems to occupancy and vacancy characteristics for both ventilation and temperature control.

Domestic Hot Water

Domestic hot water use is a particularly large component of building energy use in residential and hospitality project types.

- Reduce fixture flows to reduce overall hot water demand.

zEPI: The Path to Zero Energy in Building Energy Codes



The Zero Energy Performance Index (zEPI) is a relative scale that allows various levels of building energy performance to be compared against each other. zEPI sets an energy use intensity (EUI) target for building type and is adjusted for climate. This graph charts zEPI scores for the current national model energy codes and standards.

- Reduce supply run length and volume to reduce standby heat loss.
- Incorporate waste heat recovery or solar thermal systems to serve hot water needs.

Plug and Equipment Loads

As HVAC and lighting demand decrease, plug and equipment loads to serve occupant needs are becoming one of the most significant loads in building energy use. Strategies to insure that equipment is off when not in use, and to deploy the most energy efficient appliances can significantly reduce overall building energy use .

While the measures described here go a long way to defining a 20% Stretch Code, NBI has developed additional information and support to offer jurisdictions considering a stretch code. To learn more, contact Webly Bowles at webly@newbuildings.org.



623 SW Oak St., 3rd Floor
Portland, OR 97205

503 761 7339

newbuildings.org

New Buildings Institute (NBI) is a nonprofit organization driving better energy performance in commercial buildings. We work collaboratively with industry market players—governments, utilities, energy efficiency advocates and building professionals—to promote advanced design practices, innovative technologies, public policies and programs that improve energy efficiency. We also develop and offer guidance and tools to support the design and construction of energy efficient buildings.

Copyright © 2017 New Buildings Institute, Inc. All rights reserved.

BOROUGH OF SWARTHMORE (2014 update)

Applicant _____

For Office Use Only

Project Address _____

Points Received _____

Contact Name/Phone _____ / _____

Reviewer _____

 New Construction Remodel Addition**Green Points Worksheet**

PLEASE NOTE THAT GREEN POINTS WILL BE GIVEN ONLY FOR ITEMS THAT ARE IN EXCESS OF THE PENNSYLVANIA UNIFORM CONSTRUCTION CODE AND/OR SWARTHMORE BOROUGH SUBDIVISION AND LAND DEVELOPMENT REGULATIONS

1 CONSTRUCTION • DEMOLITION • USE OF RECYCLED MATERIALS*Deconstruction Plan Submitted with Permit Application* 1 Point..... _____*Deconstructed Materials Donated to a Reseller* 1 Point..... _____*Use of Reclaimed Lumber* 5 Points..... _____*Construction Debris Recycled (75% + or complete demolition)* 3 Points..... _____*Recycled Content Carpeting* 2 Points..... _____*Recycled Plastic in Deck Material* 2 Points..... _____*Recycled Content Sheathing* 1 Point..... _____*Recycled Content or Fiber Cement Siding* 3 Points..... _____*Recycled Content Roofing* 3 Points..... _____**2 COMPACT LAND USE • WATER CONSERVATION***Compact Building Footprint (New Construction)**Lot coverage 10% less than zoning maximum* 3 Points..... _____*Lot coverage 5% less than zoning maximum* 2 Points..... _____*Landscape (New Construction)**Reduction of turf areas and lawns kept to a minimum* 3 Points..... _____*Appropriate use of low water demanding plants* 2 Points..... _____*Zoned irrigation system separating turf from shrub areas and low water demand areas from high water demand areas that includes drip irrigation zones.* 3 Points..... _____*Water Conservation by Performance Procedure (1-6 Points)* 1 Point: 10,000 gallons of annual water saving..... _____ 2 Points: 20,000 gallons of annual water saving..... _____ 3 Points: 30,000 gallons of annual water saving..... _____ 4 Points: 40,000 gallons of annual water saving..... _____ 5 Points: 50,000 gallons of annual water saving..... _____

6 Points: 60,000 gallons of annual water saving.....

Use of Engineered Swales to Filter Storm Water Runoff (only applicable if not required by Stormwater Permit)

3 Points.....

Planting Two Trees beyond Required Street Trees (up to 6 points)(New Construction/Land Development)

1 point for each additional tree planted (up to 6 trees)

Total number of trees _____=total points

_____ Points.....

3 FRAMING

Incorporate Optimal Value Engineering (OVE) Framing Techniques

2 Points.....

Oriented Strand Board (OSB) Subfloors

1 Point.....

Oriented Strand Board (OSB) Wall Sheathing

1 Point.....

Finger-Jointed Studs Used for Wall Framing

2 Points.....

Forest Stewardship Council (FSC) Certified Harvested Lumber Used for Framing

5 Points.....

Engineered Lumber Used (Floors)

1 Point.....

Engineered Lumber Used to Replace 2x10s or 2x12s for Structural Applications

1 Point.....

Structural Alternatives to Wood

5 Points.....

Structural Insulated Panels Used for Exterior Walls

4 Points.....

4 ENERGY CODE MEASURES

The Pennsylvania Uniform Construction Code requires certain minimum measures of energy conservation for new buildings, additions, and remodels. These can be calculated using prescriptive methods for each assembly or item, or performance standards for the overall structure, or a combination. **This subsection specifies how points are to be awarded under this section for incremental increase in energy efficiency above the required minimum in each of the categories specified in the table.** The applicant shall complete a form to calculate the points awarded for such incremental increases.

Insulated Assembly	Points (circle)	
Glass R / U Value (As determined by the National Fenestration Rating Council)		
2 / 0.5	0	
2.2 / .45	2	
2.5 / 0.4	4	
2.8 / 0.35	6	
3.3 / 0.3	8	
U-0.25 or less	10	
Wall Insulation		
R-19	1	
R-24	2	
R-25 or greater	4	
Ceiling Insulation		
R-30	0	

R-34	1	
R-38	2	
R-42	3	
R-43 or greater	5	
Floor Insulation		
R-19	1	
R-24	2	
R-25 or greater	3	
Basement Insulation		
R-10	0	
R-13	1	
R-19	2	
R-24	3	
R-25 or greater	4	
Slab Insulation		
R-5	0	
R-7	1	
R-10	2	
R-15	0	
Crawl Space Insulation		
R-15	0	
R-19	1	
R-24	2	
Heating Equipment		
Furnaces and Boilers		
78% AFUE	0	
84% AFUE	2	
90% AFUE	4	
94% AFUE	6	
Air Conditioning		
11 SEER	0	
12 SEER	2	
13 SEER	4	
14 SEER	6	
15 SEER or greater	8	
Total Insulation Points =		

5 PLUMBING

Tankless Domestic Hot Water Heaters

- 1 Point _____
"On Demand" Hot Water Switch
 1 Point _____

6 ELECTRICAL

Efficient Appliances

Energy Star Dishwasher Installed (Provide Manufacturers Spec Sheet)

1 Point _____

Energy Star Clothes Washer Installed (Provide Manufacturers Spec Sheet)

1 Point _____

Energy Star Refrigerator Installed (Provide Manufacturers Spec Sheet)

1 Point _____

Energy Star Freezer Installed (Provide Manufacturers Spec Sheet)

1 Point _____

1 Point _____

Clothesline Installed

1 Point _____

LEDs Installed (1-3 points)(show on Lighting Plan)

1 Point: 4 LED bulbs _____

2 Points: 8 LED bulbs _____

3 Points: 12 LED bulbs _____

Energy Efficient Lighting Controls Installed (provide documentation)

2 Points _____

7 INSULATION

Wall Insulation is 80% Recycled Material and/or Wet-Spray Insulation

2 Points _____

Ceiling Insulation is 80% Recycled Material and/or Wet-Spray Insulation

2 Points _____

Windows (only one of the following three may be used)

- Single-pane Windows Changed out for Double-pane (up to maximum 10 points)

0.5 points per window for additions and remodels

Calculate: total number of windows _____ x 0.5 = total points _____

_____ Points _____

- Single-pane Windows Changed out for Low Emissivity Window (up to maximum 10 points)

1 point per window for additions and remodels

Calculate: total number of windows _____ = total points _____

_____ Points _____

- Single-pane Windows Changed out with argon/HM Windows (up to maximum 10 points)

1.5 points per window for additions and remodels

Calculate: total number of windows _____ x 1.5 = total points _____

_____ Points _____

Existing Ceiling Insulated to R-38 (or to capacity for fixed space – not to be combined with Section 4)

2 points for additions and remodels

5 Points _____

Existing Walls Insulated to Capacity (not to be combined with Section 4)

3 points for additions and remodels

7 Points _____

Install Recycled-Content, Formaldehyde-Free Fiberglass Insulation

2 Points _____

8 HEATING AND COOLING

Air Destratification Systems

1 Point _____

Natural Cooling (provide design schematics)

2 Points _____

Evaporative Cooling Installed

6 Points _____

Vapor Permeable Infiltration Barrier

1 Point..... _____

Whole House Fan

2 Points..... _____

Convert Electric Heat to Gas Heat (addition and remodels only)

5 Points

Replace Electric Water Heater with Gas Water Heater (additions and remodels only)

3 Points..... _____

Hydronic Baseboard Heat

3 Points..... _____

Radiant Floor Heat

3 Points..... _____

Geothermal Heat or Air to Air Heat Exchanger (Heat Recovery Ventilation)

8 Points..... _____

9 SOLAR

Passive Solar Potential Preservation and Solar Space Heating

5 Points for the Following Items:

- (i) *A wall surface is provided equal to 10% of the unit's floor area or 150 square feet—whichever is greater*
- (ii) *Which is located on the more southerly side of the unit*
- (iii) *Which is oriented within thirty degrees of a true east-west direction*
- (iv) *Which is immediately adjacent to a heated space*
- (v) *Which is not shaded between 10:00am and 2:00pm on the winter solstice; and is totally shaded between 10:00am and 2:00pm on the summer solstice*
- (vi) *Which has unimpeded solar access*
(The Building Official shall be authorized to make determinations as to compliance with the above criteria)

5 Points each..... _____

Glazing of the south wall surface adequate to provide at least 20% Passive Solar Heating

6 Points..... _____

Glazing of the south wall surface adequate to provide at least 40% Passive Solar Heating, but only if designed in conjunction with an appropriately sized thermal mass so as not to affect adversely cooling loads

12 Points..... _____

Glazing of the south wall surface adequate to provide at least a 60% Passive Solar Heating, but only if designed in conjunction with an appropriately sized thermal mass so as not to affect adversely cooling loads

20 Points..... _____

Solar Hot Water Heating

10 Points..... _____

Active Solar Space Heating with a calculated savings fraction of

8 Points: 30%..... _____

12 Points: 40%..... _____

16 Points: 50%..... _____

20 Points: 60%..... _____

Active Solar Pre-Plumbing

2 Points..... _____

Solar Generated Electricity with a Savings Fraction of at Least 25%

20 Points..... _____

10 INNOVATION POINTS

Install Infrastructure to Support Current or Future Alternative Fuel Vehicle Use

1 Point..... _____

Innovative Product or Design Points (up to 10 points)

(to be awarded based on demonstrated energy or resource conservation savings)

_____ Points..... _____