
# LEED™

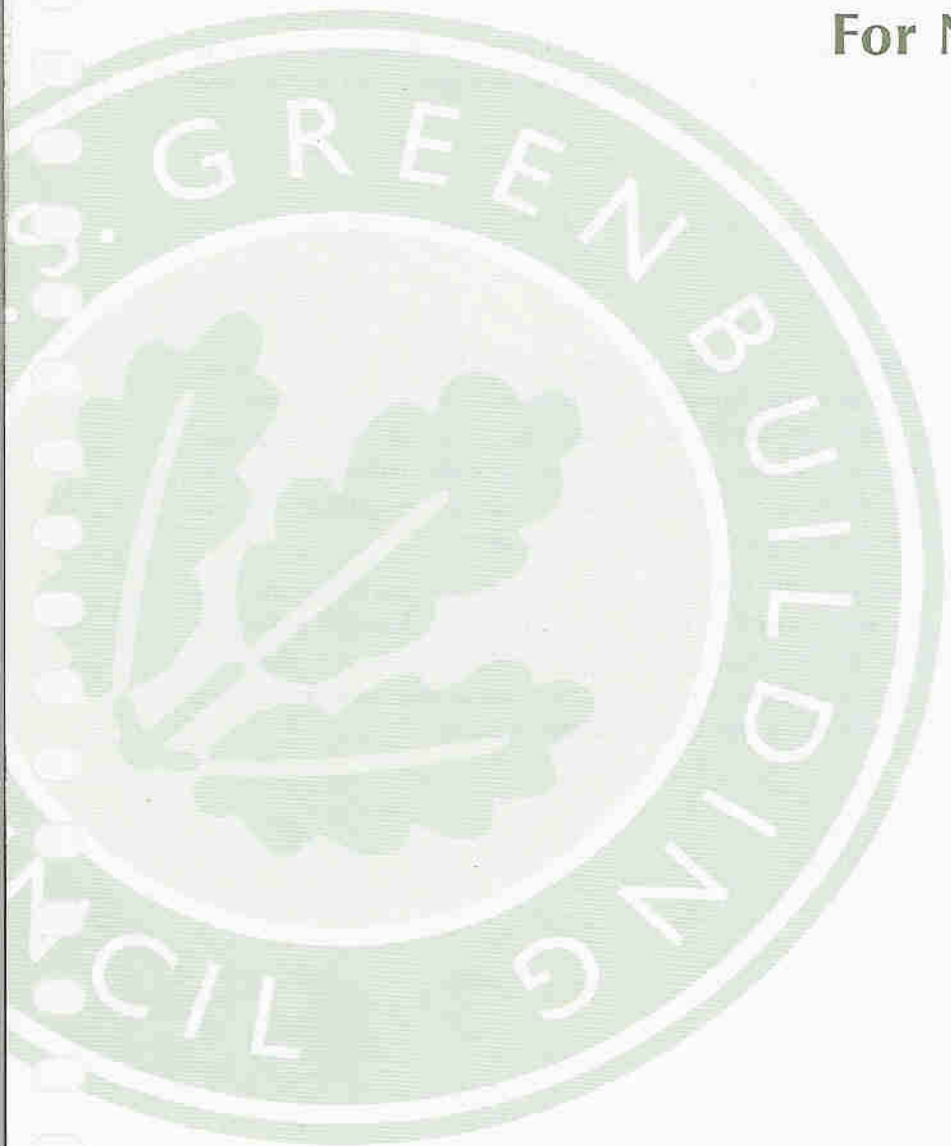
LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

# Reference Guide

## For New Construction & Major Renovations

(LEED-NC)

*Version 2.1*

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U.S. Green Building Council
1015 18th Street NW, Suite 805
Washington, DC 20036

# Table of Contents


**Foreword** iii

**Introduction** 1

Green Building Design 1
LEED Green Building Rating System™ 2
LEED Reference Guide 3
LEED Certification Process 4

**Sustainable Sites** 7

Prerequisite 1 Erosion & Sedimentation Control 9
Credit 1 Site Selection 13
Credit 2 Development Density 19
Credit 3 Brownfield Redevelopment 25
Credit 4 Alternative Transportation 31
Credit 5 Reduced Site Disturbance 43
Credit 6 Stormwater Management 49
Credit 7 Heat Island Effect 59
Credit 8 Light Pollution Reduction 69

**Water Efficiency** 79

Credit 1 Water Efficient Landscaping 81
Credit 2 Innovative Wastewater Technologies 91
Credit 3 Water Use Reduction 99

**Energy & Atmosphere** 109

Prerequisite 1 Fundamental Building Systems Commissioning 111
Prerequisite 2 Minimum Energy Performance 121
Prerequisite 3 CFC Reduction in HVAC&R Equipment 129
Credit 1 Optimize Energy Performance 133
Credit 2 Renewable Energy 151
Credit 3 Additional Commissioning 165
Credit 4 Ozone Depletion 169
Credit 5 Measurement & Verification 173
Credit 6 Green Power 181

## Materials & Resources 185

| | | |
|---|---|---|
| Prerequisite 1 | Storage & Collection of Recyclables | 187 |
| Credit 1 | Building Reuse | 191 |
| Credit 2 | Construction Waste Management | 199 |
| Credit 3 | Resource Reuse | 207 |
| Credit 4 | Recycled Content | 213 |
| Credit 5 | Regional Materials | 221 |
| Credit 6 | Rapidly Renewable Materials | 227 |
| Credit 7 | Certified Wood | 231 |

## Indoor Environmental Quality 239

| | | |
|---|---|---|
| Prerequisite 1 | Minimum IAQ Performance | 241 |
| Prerequisite 2 | Environmental Tobacco Smoke (ETS) Control | 245 |
| Credit 1 | Carbon Dioxide ($CO_2$) Monitoring | 249 |
| Credit 2 | Ventilation Effectiveness | 253 |
| Credit 3 | Construction IAQ Management Plan | 261 |
| Credit 4 | Low-Emitting Materials | 269 |
| Credit 5 | Indoor Chemical & Pollutant Source Control | 279 |
| Credit 6 | Controllability of Systems | 283 |
| Credit 7 | Thermal Comfort | 293 |
| Credit 8 | Daylight & Views | 301 |

## Innovation & Design Process 311

| | | |
|---|---|---|
| Credit 1 | Innovation in Design | 313 |
| Credit 2 | LEED Accredited Professional | 317 |

## Index of Definitions 319

# Foreword

## The New Reference Package

The second edition of the Reference Package corresponds to LEED Version 2.1 for New Construction and Major Renovations (LEED-NC). Printed components of the Reference Package include the updated Rating System and Reference Guide. The remainder of the Reference Package, provided in electronic form via download from a secure page on the USGBC Web site, contains the following:

- Bookmarked PDF files of the Reference Guide to allow convenient on-screen viewing while traveling, either stored on a laptop computer or through any computer with Internet access.
- LEED Version 2.1 Letter Template, a dynamic tracking and documentation tool that is used by project teams to track progress and prepare a LEED application. The Template is occasionally improved, uploaded and dated for reference.
- LEED Version 2.0 Reference Guide files, for professionals working on Version 2.0 projects.

## The Revised Reference Guide

This edition of the Reference Guide was developed for two main reasons: to correspond with LEED-NC Version 2.1 Rating System, and to improve the content. In response to USGBC members and other LEED users, LEED-NC Version 2.1 provides technical clarifications and streamlines certification submittal requirements. Performance levels have not changed from Version 2.0 (see the Introduction section for related discussion), although calculation methodologies for several credits have been modified.

The Version 2.0 Rating System components—intent, requirements and submittals—were the first to be reviewed and judiciously altered for Version 2.1 by LEED technical committees with guidance from the LEED Steering Committee. The Letter Template approach to documentation and application submittal have been incorporated into the Reference Guide, as have clarifications made to LEED requirements.

The revised Reference Guide includes corrections and clarifications that have been requested by users (often through the Credit Interpretation process), technical committees and staff. Procurement details for referenced standards are more specific. Web site resource sections are now updated and in some cases expanded. General improvements have been made to content and text. *Please note that while key details for most prerequisites and credits remain unchanged from LEED Version 2.0 and its Reference Guide,* SS Credit 8 (Light Pollution), MR Credit 4 (Recycled Content) and EQ Credit 6 (Controllability of Systems) have been *substantially overhauled,* and thus should be thoroughly reviewed by LEED practitioners.

In addition, significant changes or corrections have been made, or helpful details added, to the requirements or calculation methodologies of SS Credit 3 (Brownfield Redevelopment), SS Credit 4.3 (Alternative Fuel Vehicles), SS Credit 6 (Stormwater Management), EA Commissioning Prerequisite and Credit, EA Energy Performance Prerequisite and Credit, EA Credit 6 (Green Power), MR Credit 7 (Certified Wood), IEQ Credit 4 (Low-Emitting Materials), and IEQ Credit 7.1 (Thermal Comfort: Compliance). Other sections may have been edited to a lesser extent but may still contain corrections and clarifications of interest.

## Acknowledgements

At the October 2001 Board of Directors meeting, a Special Task Force was established to address important issues arising from the market uptake of the LEED Green Building Rating System. Pursuant to Special Task Force recommendations and the Board's directive, the charge to develop LEED Version 2.1 was given by the LEED Steering Committee to the LEED Version 2.x Committee and the LEED Technical Advisory Groups (TAGs), which consist of industry experts from USGBC member organizations. Some of the TAG recommendations could be not be implemented for Version 2.1 due to scope limitations. USGBC greatly appreciates their efforts during this process and looks forward to implementing more substantial improvements in the next version of LEED. The Reference Guide revision process was managed and implemented by USGBC staff and included review and suggestions by many core TAG members. We extend our deepest gratitude to all these individuals for their heroic volunteer efforts and constant support of USGBC's mission.

**LEED Steering Committee**

Paul von Paumgartten (Co-Chair), Johnson Controls, Inc.
Rob Watson (Co-Chair), Natural Resources Defense Council

Michael Arny, Leonardo Academy
Lynne Barker, City of Seattle
Penny Bonda, LC Clark Publishing Co.
Ann Edminster, Design AVEnues
Christine Ervin, U.S. Green Building Council
Donald Fournier, University of Illinois Building Research Council
J. Gary Gardner, Davis Gardner Gannon Pope
Jim Goldman, Turner Construction
Nigel Howard, U.S. Green Building Council
Jerry Lea, Hines
Malcolm Lewis, CTG Energetics, Inc.
Gail Lindsey, Design Harmony, Inc.
Christine Magar, Southern California Edison
Dru Meadows, The GreenTeam, Inc.
Tom Paladino, Paladino & Company, Inc.
Steven Piguet, Flad & Associates (previously of Armstrong)
William Reed, Natural Logic, Inc.
Tom Scarola, Tishman Speyer Properties

**Board of Directors' Special Task Force**

Harry Gordon (Chair), Burt Hill Kosar Rittelman

Lucia Athens, City of Seattle
Robert Berkebile, BNIM Architects
Christine Ervin, U.S. Green Building Council
Nigel Howard, U.S. Green Building Council
Malcolm Lewis, CTG Energetics, Inc.
Lynn Simon, Simon & Associates
Paul von Paumgartten, Johnson Controls, Inc.

William Reed, Natural Logic, Inc.
Alan Traugott, Flack + Kurtz Inc.
Rob Watson, Natural Resources Defense Council
Jerry Yudelson, Green Building Services

**LEED Version 2.x Committee**

Gail Lindsey (Co-Chair), Design Harmony, Inc.
William Reed (Co-Chair), Natural Logic, Inc.

Michael Arny (Chair, LEED for Existing Buildings), Leonardo Academy
John Boecker (Chair, Innovation & Design Technical Advisory Group), L. Robert Kimball & Associates, Inc.
Penny Bonda (Chair, LEED for Commercial Interiors), LC Clark Publishing Co.
Donald Fournier (Chair, Multiple Buildings Committee), University of Illinois Building Research Council
Tom Paladino, Paladino & Company, Inc.
Joel Ann Todd
Chairpersons of the Technical Advisory Groups (see below)

**Sustainable Sites Technical Advisory Group**

Bryna Dunn (Chair), Moseley Architects

Ann Abel, Wenk Associates
Gina Baker, Burt Hill Kosar Rittelmann
Mark Brumbaugh, Brumbaugh & Associates
Meg Calkins, University of Illinois at Urbana-Champaign
Stewart Comstock, Maryland Department of the Environment
Mary Pat Crozier, Furman University
Jay Enck, Commissioning & Green Building Services
Jim Frierson, Advanced Transportation Technology Institute
Ron Hand, G&E Environmental
Charlene Harper, Timmons Group
Susan Kaplan, Battery Park City Authority
Michael Lane, Lighting Design Lab
Mark Loeffler, The RETEC Group, Inc.
Zolna Russell, Hord Coplan Macht, Inc.
Gale Spencer, Interface Engineering
Eva Wong, U.S. EPA Heat Island Reduction Initiative (HIRI)

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David Nelson, Clanton & Associates, for fixing SS Credit 8

**Energy & Atmosphere Technical Advisory Group**

Greg Kats (Chair), Capital E

Robert Berkebile, BNIM Architects
William Browning, Rocky Mountain Institute
Chad Dorgan, Farnsworth Group, Inc.

Charles Eley, Eley Associates
John Hogan, City of Seattle Department of Design, Construction, and Land Use
Bion Howard, Building Environmental Science
Satish Kumar, Lawrence Berkeley National Laboratory
Daniel Nall, Flack+Kurtz Inc.
William Prindle, American Council for an Energy Efficient Economy
Jim Rogers, James K. Rogers, PE
Bob Rose, U.S. Environmental Protection Agency
Mick Schwedler, Trane

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John Hogan for his expertise on EA Prerequisite 2 and Credit 1

**Materials & Resources Technical Advisory Group**

Nadav Malin (Chair), BuildingGreen, Inc.

Ann Edminster, Design AVEnues
Chris Dixon, Mithun Architects+Designers+Planners
W. Laurence Doxsey, U.S. Department of Housing and Urban Development
Nancy Malone, Siegel & Strain Architects
Kirsten Ritchie, Scientific Certification Systems
Wayne Trusty, Athena Institute
Gail Vittori, Center for Maximum Potential Building System
Mark Webster, Simpson Gumpertz & Heger
Gabe Wing, Herman Miller, Inc.
Keith Winn, Catalyst Partners

**Indoor Environmental Quality Technical Advisory Group**

Kirsten Childs (Chair), Croxton Collaborative Architects, P.C.

Jude Anders, Johnson Controls, Inc.
Valerie Bennett, Envirosense Consortium, Inc.
Terry Brennan, Camroden Associates
Brian Cloward, Mithun Architects+Designers+Planners
Jason McLennan, BNIM Architects
Hernando Miranda, SolTierra
David Nelson, Clanton & Associates

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The establishment and success of LEED and its supporting documents is greatly due to support from the U.S. Department of Energy (DOE). The LEED Version 1.0 Reference Guide and Pilot Program were developed by the U.S. Green Building Council under grant DE-FG36-97GO10268 from the DOE Office of Energy Efficiency and Renewable Energy, Building Technology, State and Community Program. USGBC sincerely thanks DOE for kickstarting our efforts to transform the building industry, and for its continued support.

## About USGBC

The built environment has a profound impact on our natural environment, economy, health and productivity. Breakthroughs in building science, technology, products and operations are now available to designers, builders and owners who want to build green and maximize both economic and environmental performance.

The U.S. Green Building Council (USGBC) is leading a national consensus to produce a new generation of buildings that deliver high performance inside and out. Council members work together to develop industry standards, design guidelines, policy positions, conferences and educational tools that support the adoption of sustainable design and building practices. As the only national coalition that represents the entire building industry on environmental building matters, our unique perspective and collective power provides our members with enormous opportunity to initiate change in the way buildings are designed, built, and maintained.

Our membership is comprised of leaders representing the following categories:

Architectural Firms
Building Commissioning Providers
Building Control Service Contractors and Manufacturers
Building Owners, Managers, Users, and Brokers
Contractors and Builders
Consultants
Engineering Firms
Environmental Groups
Financial and Insurance Firms
Government
Manufacturers
Planners
Press
Professional Societies
Real Estate Developers
State, Local, and Federal Governments
Universities and Technical Research Institutes
Utilities

Since its inception in 1993, USGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. Council programs are:

**Committee-Based**

The heart of this effective coalition is our committees in which members design strategies that are implemented by staff and expert consultants. Our committees provide a forum for members to resolve differences, build alliances, and forge cooperative solutions for influencing change in all sectors of the building industry.

**Member-Driven**

The Council's membership is open and balanced and provides a platform for carrying out important programs and activities. We target the issues identified by our members as the highest priority. We conduct an annual review of achievements that allows us to set policy, revise strategies and devise work plans based on members' needs.

**Consensus-Focused**

We work together to promote green buildings and in doing so, we help foster greater economic vitality, environmental health and occupant well-being at lower cost. The various industry segments bridge ideological gaps to develop balanced policies that benefit the entire industry.

## USGBC Membership

The strength and diversity of the USGBC coalition provides the advantages of significantly enhancing the resources and the effectiveness of its individual members. Our voice is credible and powerful because of the diversity and balance of our membership. We strongly encourage you to join the Council. Your involvement is crucial to the success and impact of our initiatives.

Member benefits include:

- Marketing, educational and networking opportunities through USGBC events, programs and publications
- Recognition as an industry leader in supporting a better built environment
- Opportunity to participate in local chapters
- Discounts on LEED certification, resource materials and training programs
- The USGBC newsletter

Join the Council and take advantage of this opportunity to accelerate change and help shape the green building industry.

For more information:

**U.S. Green Building Council**
1015 18th Street NW, Suite 805
Washington, DC 20036
(202) 828-7422 Phone
(202) 828-5110 Fax
www.usgbc.org
info@usgbc.org
leedinfo@usgbc.org

# Introduction

## Green Building Design

The term "green building" is synonymous with "high-performance building," "sustainable design and construction" as well as other terms that refer to a holistic approach to design and construction. There are many different conceptions of green building design due to the large scope of sustainability issues and the novelty of sustainable principles. Definitions of environmental sustainability range from broad concepts that incorporate all aspects of sustainability—meeting the needs of today without compromising the ability of future generations to meet their needs—to narrow definitions focused on one specific sustainable design feature such as energy-efficiency. Within this broad spectrum, green building design strives to balance environmental responsibility, resource efficiency, occupant comfort and well-being, and community sensitivity.

Green building design includes all players in an integrated development process, from the design team (building owners, architects, engineers and consultants), the construction team (materials manufacturers, contractors and waste haulers), maintenance staff, and building occupants. The green building process results in a high-quality product that maximizes the owner's return on investment.

### Why Design Green?

The building sector has a tremendous impact on the environment. In 2002, there were more than 76 million residential buildings and nearly five million commercial buildings in the United States. According to the U.S. Department of Energy (DOE), buildings in the United States consume more than 30% of our total energy and 60% of our electricity annually. Five billion gallons of potable water are used to flush toilets daily. A typical North American commercial construction project generates up to 2.5 pounds of solid waste per square foot of floor space. Real estate development appropriates land from other uses such as natural habitats and agriculture.

Buildings are a major source of the pollutants that cause urban air quality problems and contribute to climate change. According to the DOE, buildings account for 49% of sulfur dioxide emissions, 25% of nitrous oxide emissions, and 10% of particulate emissions – all of which damage urban air quality. Buildings produce 35% of the country's carbon dioxide emissions. These are just a few examples of the environmental impacts associated with the construction and operation of buildings.

By the year 2010, another 38 million buildings are expected to be built. Green building practices can substantially reduce the negative environmental impacts associated with these buildings and reverse the trend of unsustainable construction activities. But that is only part of the story. Green design also reduces operating costs, enhances building marketability, potentially increases occupant productivity, and helps create a sustainable community. For example, energy efficiency measures have reduced operating expenses of the Denver Dry Goods building by approximately $75,000 per year. Students in daylit schools in North Carolina consistently score higher on tests than students in schools using conventional lighting fixtures. Studies of workers in green buildings reported productivity gains of up to 16%, including reductions in absenteeism and improved work quality, based on "people-friendly" green design. Waste

management costs were reduced by 56% and 48 tons of waste were recycled during construction of a grocery store in Spokane, Washington. Resource-efficient buildings have less impact on local infrastructure. Green design has environmental, economic, and social elements that benefit all stakeholders, including owners, occupants and the general public.

## The Leadership in Energy and Environmental Design™ (LEED™) Green Building Rating System

### History of LEED

Following the formation of the U.S. Green Building Council (USGBC) in 1993, the membership quickly realized that a priority for the sustainable building industry was to have a system to define and measure that which should qualify as a "green building." The USGBC began to research existing green building metrics and rating systems. Less than a year after formation, the membership followed up on the initial findings with the establishment of a committee to focus solely on this topic. The diverse initial composition of the committee included architects, realtors, a building owner, a lawyer, an environmentalist and industry representatives. This cross-section of people and professions added a richness and depth both to the process and to the ultimate product.

As part of their investigations, the committee reviewed existing green building rating systems such as BREEAM (Building Research Establishment Environmental Assessment Method) and BEPAC (Building Environment Performance Assessment Criteria), both from the United Kingdom. Three options were assessed: (1) Accept the BREEAM rating system and use it in the U.S. market; (2) tailor the BREEAM system to the U.S. market; or (3) create a separate U.S. green building rating system. The third option was selected because the committee felt a strong need for a green building measurement tool specific to the U.S. building market.

By the fall of 1994, the committee had prepared a draft green building rating system for review. After additional development, the LEED Version 1.0 Pilot Program was launched at the USGBC Membership Summit in August 1998. Twelve projects completed the application process and were recognized as LEED Certified Pilot Projects in March 2000.

Based on the success of LEED Version 1.0, an expert review session was held at Pocantico, New York in 1999 to shape LEED Version 2.0. After extensive modifications, the revised rating system was presented to the USGBC membership for a review and comment period, and a final approval vote. LEED Version 2.0 was released in March 2000. Grants from the U.S. Department of Energy (Office of Building Technologies, State and Community Programs) provided start-up funding for the pilot program, the development of the LEED Reference Guides, and the initial LEED Training Workshop. Sustainable design and technology information can be found on the U.S. DOE Web pages, including www.eere.energy.gov/buildings and www.sustainable.doe.gov.

The LEED Committee has since divided into the Steering Committee, several product committees and credit category-specific Technical Advisory Groups (TAGs). The TAGs are subcommittees that consist of industry experts who assist in developing credit interpretations and technical improvements to the system.

The keys to making this process and product work have been a strong common goal to produce a consensus-based rating system, a continually positive approach throughout difficult decision-making dis-

cussions, and a diversity of committed team players. Since the collective knowledge regarding green buildings continues to increase, LEED will continue to be a dynamic and ever-changing system needing the input, scrutiny, and involvement of diverse stakeholders.

The LEED flagship product is now called LEED for New Construction and Major Renovations (LEED-NC). This distinction is necessary as rating system products are being developed and launched for other market sectors, such as existing buildings, commercial interiors, and core and shell (speculative development).

### LEED-NC Version 2.1

Consistent with USGBC policy for the continuous improvement of LEED, Version 2.1 is an administrative update of LEED-NC Version 2.0. Its purpose is to address concerns raised by USGBC members and other LEED users by providing technical clarifications and streamlining the documentation requirements for LEED certification.

These improvements are expected to simplify the documentation process for project teams and to reduce the costs of documenting LEED credits while retaining the stringency and integrity of the LEED Version 2.0 standards. An approval vote by USGBC membership was not required for Version 2.1 because performance levels have not been altered. In a few instances, methodologies have changed in order that they may be more straightforward or more comprehensive. The new LEED Letter Template is a central component of the Version 2.1 improvements (see below for more information).

### Features of the System

The LEED Green Building Rating System is a voluntary, consensus-based, market-driven building rating system that is based on accepted energy and environmental principles and strikes a balance between established practices and emerging concepts. It evaluates environmental performance from a whole-building perspective, providing a definitive standard for what constitutes a "green building." The development of LEED was instigated by the USGBC Membership, representing all segments of the building industry and has been open to public scrutiny.

LEED for New Construction and Major Renovations (LEED-NC) is a measurement system designed for rating commercial and institutional buildings, with a focus on office buildings. LEED-NC has also been applied to many other building types, including high-rise residential buildings.

The rating system is organized into five environmental categories: Sustainable Sites, Water Efficiency, Energy & Atmosphere, Materials & Resources, and Indoor Environmental Quality. An additional category, Innovation & Design Process, addresses sustainable building expertise as well as design measures not covered under the five environmental categories.

LEED is a performance-oriented system where points are earned for satisfying performance criteria. Different levels of green building certification are awarded based on the total points earned. The system is designed to be comprehensive in scope, yet simple in operation.

## LEED Reference Guide

The Reference Guide is the user's manual for LEED. The Guide is intended to assist project teams in understanding LEED criteria. The Guide includes examples of strategies, case studies of buildings that have implemented these strategies successfully, and links to other resources. The Guide does not provide an exhaustive list of strategies for meeting the criteria, nor does it provide all of the information that design teams need to determine the applicability of a credit to their project.

### Prerequisite and Credit Format

Each prerequisite and credit chapter in the Reference Guide is organized in a standardized format for simplicity and quick reference. The first section summarizes key points regarding the measure's intent and requirements. The subsequent sections provide supportive information to help interpret, implement, and document performance. The standard chapter sections are described in the following paragraphs.

**Intent** identifies the main goal of the prerequisite or credit.

**Requirements & Submittals** specify the criteria to satisfy the prerequisite or credit, the number of points available, and the documentation required for the LEED application. The prerequisites *must* be achieved. Each credit is optional, but contributes to the project's point total. Some credits are divided into two or more subcredits with independent or cumulative points.

**Summary of Referenced Standards** cites the technical standard(s) that LEED uses for performance evaluation. A brief summary of the standard is also provided in this section. Users are strongly encouraged to review the standard and not rely solely on the summary, unless otherwise noted.

**Green Building Concerns** related to the prerequisite or credit are explained in this section and divided into environmental, economic and community issues.

**Design Approach** presents ideas and recommendations for the project design and specifications.

**Synergies & Trade-Offs** identify areas of significant interaction with other LEED credits. Users are advised to carefully evaluate the benefits and disadvantages of pursing these related credits.

**Calculations** are sample formulas or computations to assist with the determination of compliance for a particular prerequisite or credit. Some calculations have been programmed into the LEED Version 2.0 Calculator and the LEED Version 2.1 Letter Template, both Microsoft Excel spreadsheets. These files are made available to registered projects in order to facilitate the application process.

**Resources** such as Web sites and print media are provided for further research and to assist justification, design and calculations efforts.

A **Case Study** is provided to show how a project has served the goals stated for the prerequisite or credit. The selected project exemplifies one method to achieve the intent of the measure, although there may be other methods.

## LEED Certification Process

### Eligibility

All commercial buildings as defined by standard building codes are eligible for certification as a LEED building. Commercial occupancies include (but are not limited to) offices, retail and service establishments, institutional buildings (libraries, schools, museums, churches, etc.), and hotels and residential buildings of four or more habitable stories.

Hotels and residential buildings of three habitable stories or less are addressed by the LEED Version 2.0 Application Guide for Lodging, available for download from the USGBC Web site. If the application of LEED for a unique building type is questionable, USGBC encourages the project team to tally a potential point total using the checklist in the LEED Rating System.

### Registration

Project teams interested in obtaining LEED certification for their project must first register through the USGBC Web site. The Web site includes information

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Project teams interested in obtaining LEED certification for their project must first register through the USGBC Web site. The Web site includes information

on registration costs for USGBC member as well as non-members. Registration during the early phases of project design will ensure maximum potential for achieving certification.

Registration is an important step that establishes contact with the USGBC and provides access to essential information, software tools, and communications. Upon registration, project contacts receive access to resources that explain and facilitate the LEED application process.

## Documentation

Once a project is registered, the project design team begins to prepare documentation to satisfy the prerequisite and credit submittal requirements. This documentation will become the bulk of the project's LEED Version 2.0 application, or the proof behind performance declarations in the Version 2.1 application. It is helpful to have a LEED Accredited Professional as the project contact and team member responsible for coordinating the certification process.

Projects may submit using either version's documentation path (it is simplest to create a LEED application pursuant to one method of documentation), or a mixed submittal of the two (per credit). Mixed submittals are recommended for projects that registered under Version 2.0, but would like to transition to Version 2.1 in order to take advantage of the streamlined Letter Template submittal path. Documentation should be gathered throughout the design and construction phases. Use the software tools and templates provided for Version 2.0 and/or Version 2.1 as appropriate.

LEED Version 2.0 submittal resources consist of the Welcome Packet, Calculator (spreadsheets) and Application Template (cover sheets for each credit). The Welcome Packet provides examples of the types of documents that LEED often requires to supplement the calculation tables and cover sheets in the application. The inclusion of extraneous documentation (anything that is not listed as a credit submittal requirement) is discouraged, as this slows the review process. Full building commissioning reports, for example, are not necessary because only the commissioning plan is required.

The LEED Version 2.1 Letter Template is a dynamic tracking and documentation tool that is used by project teams to track progress and prepare a LEED application. For each credit, the Letter Template prompts LEED practitioners for summary data and signed declarations of performance, indicates when documentation requirements have been adequately fulfilled for submittal, serves as a letter template for printing on letterhead, and summarizes progress. Some of the Template pages include spreadsheets for calculations, while others are simple declarations signed by an appropriate team member. The Version 2.0 Calculator spreadsheets are often useful when the Reference Guide calls for credit calculations but no corresponding spreadsheet exists in the Version 2.1 Letter Template.

During a Version 2.1 application review, the project team will be expected to provide supporting documents for a portion of the prerequisites and credits. Supporting documents are those which provide specific proof of meeting the required performance level – such as calculations, specifications, drawings, cutsheets, manufacturer's literature, and other source documents that were used as a basis to justify declarations of performance in the Letter Template. Many of these items are implicitly described in the Reference Guide's instructions.

## Credit Interpretations

In some cases, project teams may encounter difficulties applying a LEED prerequisite or credit to a specific project. Questions sometimes arise when the Reference

Guide does not sufficiently address a specific issue or there is a special conflict that requires resolution. USGBC has established a uniform review process for registered project inquiries, called credit interpretation requests (CIRs), to ensure that rulings are consistent and available to other projects. If a question arises, project teams should:

1. Consult the Reference Guide for a detailed description of the credit intent, requirements and calculations.
2. Review the intent of the credit or prerequisite in question to self-evaluate whether the project meets this intent.
3. Review the Credit Interpretation (CIR) Web page for previously logged CIRs on relevant credits. All LEED registered project contacts have access to this page.
4. If a similar credit interpretation has not been logged, or does not answer the question sufficiently, submit a credit interpretation request using the online form. The inquiry should be succinct and based on information found in the Reference Guide, with emphasis on the intent of the prerequisite or credit.

## Application

Consult the Web site for important details about the LEED application as well as the certification review process, schedule and fees. The applicant project must satisfactorily document achievement all of the prerequisites and a minimum number of points to attain the LEED ratings as listed below.

For more information, visit the LEED Web page on www.usgbc.org.

LEED Certification Levels

| Certification Level | Points |
|---|---|
| Certified | 26 to 32 |
| Silver | 33 to 38 |
| Gold | 39 to 51 |
| Platinum | 52 or more |