Leadership in Energy & Environmental Design Green Building Rating System, 2011

LEED 2011 For INDIA

LEADERSHIP IN ENERGY & ENVIRONMENTAL DESIGN

Green Building Rating System

For New Construction & Major Renovations

February 2011

Copyright

The Indian Green Building Council (IGBC) authorises you to view the LEED 2011 for India for your individual use. In exchange for this authorization, you agree to retain all copyright and other proprietary notices contained in the original LEED Reference Guide. You also agree not to sell or modify the LEED 2011 for India Rating System or to reproduce, display or distribute the LEED 2011 for India Rating System in any way for any public or commercial purpose, including display on a website or in a networked environment. Unauthorised use of the LEED 2011 for India Rating System violates copyright, trademark and other laws and is prohibited.

Note that the text of the central and state codes, regulations, voluntary standards, etc., reproduced in the LEED 2011 for India Rating System is either used under license to the Indian Green Building Council or, in some instances, is in the public domain. All other text, graphics, layout and other elements of content contained in the LEED 2011 for India Rating System are owned by the Indian Green Building Council and are protected by copyright under both Indian and foreign laws.

Disclaimer

None of the parties involved in the funding or creation of the LEED 2011 for India Rating System, including the Indian Green Building Council, its members, its contractors or the Indian government make any warranty (express or implied) or assume any liability or responsibility, to you or any third parties for the accuracy, completeness or use of, or reliance on, any information contained in the LEED 2011 for India Rating System, or for any injuries, losses or damages (including, without limitation, equitable relief) arising out of such use or reliance.

As a condition of use, you covenant not to sue and agree to waive and release the IGBC, its members, its contractors and the Indian government from any and all claims, demands and causes of action for any injuries, losses or damages (including, without limitation, equitable relief) that you may now or hereafter have a right to assert against such parties as a result of your use of, or reliance on, the LEED 2011 for India Rating System.

Indian Green Building Council
C/o Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Near Kothaguda Cross Roads, R R Dist
Hyderabad – 500 084

Trademark

LEED® is a registered trademark of the U.S. Green Building Council.

Acknowledgements

The LEED 2011 for India Rating System has been made possible through the efforts of many dedicated volunteers, staff members and others in the IGBC community. The Rating System drafting was managed and implemented by IGBC staff and consultants and included review and suggestions by the LEED 2011 for India Core Committee and many members. We especially extend our deepest gratitude to all of our LEED 2011 for India Core Committee members who participated in the development of this guide, for their tireless volunteer efforts and constant support of IGBC's mission.

LEED 2011 FOR INDIA - NEW CONSTRUCTION AND MAJOR RENOVATIONS PROJECT CHECKLIST

Sustainable Sites		**26 Possible Points**
Prerequisite 1	Construction Activity Pollution Prevention	Required
Credit 1	Site Selection	1
Credit 2	Development Density and Community Connectivity	5
Credit 3	Brownfield Redevelopment	1
Credit 4.1	Alternative Transportation—Public Transportation Access	6
Credit 4.2	Alternative Transportation—Bicycle Storage and Changing Rooms	1
Credit 4.3	Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles	3
Credit 4.4	Alternative Transportation—Parking Capacity	2
Credit 5.1	Site Development—Protect or Restore Habitat	1
Credit 5.2	Site Development—Maximize Open Space	1
Credit 6.1	Stormwater Design—Quantity Control	1
Credit 6.2	Stormwater Design—Quality Control	1
Credit 7.1	Heat Island Effect—Nonroof	1
Credit 7.2	Heat Island Effect—Roof	1
Credit 8	Light Pollution Reduction	1

Water Efficiency		**10 Possible Points**
Prerequisite 1	Water Use Reduction	Required
Credit 1	Water Efficient Landscaping	2-4
Credit 2	Innovative Wastewater Treatment and Reuse	2
Credit 3	Water Use Reduction	2-4

Energy and Atmosphere		**35 Possible Points**
Prerequisite 1	Fundamental Commissioning of Building Energy Systems	Required
Prerequisite 2	Minimum Energy Performance	Required
Prerequisite 3	Fundamental Refrigerant Management	Required
Credit 1	Optimize Energy Performance	1–19
Credit 2	On-site Renewable Energy	1–7
Credit 3	Enhanced Commissioning	2
Credit 4	Enhanced Refrigerant Management	2
Credit 5	Measurement and Verification	3
Credit 6	Green Power	2

Materials and Resources		**14 Possible Points**
Prerequisite 1	Storage and Collection of Recyclables	Required
Credit 1.1	Building Reuse—Maintain Existing Walls, Floors and Roof	1-3
Credit 1.2	Building Reuse—Maintain Existing Interior Nonstructural Elements	1
Credit 2	Construction Waste Management	1-2
Credit 3	Materials Reuse	1-2
Credit 4	Recycled Content	1-2
Credit 5	Regional Materials	1-2
Credit 6	Rapidly Renewable Materials	1
Credit 7	Certified Wood	1

Indoor Environmental Quality		**15 Possible Points**
Prerequisite 1	Minimum Indoor Air Quality Performance	Required
Prerequisite 2	Environmental Tobacco Smoke (ETS) Control	Required
Credit 1	Outdoor Air Delivery Monitoring	1
Credit 2	Increased Ventilation	1
Credit 3.1	Construction Indoor Air Quality Management Plan—During Construction	1
Credit 3.2	Construction Indoor Air Quality Management Plan—Before Occupancy	1
Credit 4.1	Low-Emitting Materials—Adhesives and Sealants	1
Credit 4.2	Low-Emitting Materials—Paints and Coatings	1
Credit 4.3	Low-Emitting Materials—Flooring Systems	1
Credit 4.4	Low-Emitting Materials—Composite Wood and Agrifiber Products	1
Credit 5	Indoor Chemical and Pollutant Source Control	1
Credit 6.1	Controllability of Systems—Lighting	1
Credit 6.2	Controllability of Systems—Thermal Comfort	1
Credit 7.1	Thermal Comfort—Design	1
Credit 7.2	Thermal Comfort—Verification	1
Credit 8.1	Daylight and Views—Daylight	1
Credit 8.2	Daylight and Views—Views	1
Innovation in Design		**6 Possible Points**
Credit 1	Innovation in Design	1-5
Credit 2	LEED Accredited Professional	1
Regional Priority		**4 Possible Points**
Credit 1	Regional Priority	1-4

LEED 2011 For India - New Construction and Major Renovations

100 base points; 6 possible Innovation in Design and 4 Regional Priority points

- Certified 40–49 points
- Silver 50–59 points
- Gold 60–79 points
- Platinum 80 points and above

Foreword from the IGBC

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

The Indian Green Building Council (IGBC) is coordinating the establishment and evolution of a national consensus effort to provide the industry with tools necessary to design, build and operate buildings that deliver high performance inside and out. The Council members work together to develop industry standards, design & construction practices & guidelines, operating practices & guidelines, policy positions & educational tools that support the adoption of sustainable design and building practices. Members also forge strategic alliances with key industry and research organizations, Central government agencies and state & local governments to transform the built environment. As the leading organization that represents the entire building industry on environmental building matters, the Council's unique perspective and collective power provides our members with enormous opportunity to effect change in the way buildings are designed, built, operated and maintained.

IGBC Membership

The council's greatest strength is the diversity of our membership. The IGBC is a consensus not-for-profit organization representing the entire building industry, consisting of over 1140 companies and organisations. Since its inception in 2001, the IGBC has played a vital role in providing a leadership forum and a unique, integrating force for the building industry. The Council programs are:

Committee – Based

The heart of this effective coalition is our committee structure in which volunteer members design strategies that are implemented by IGBC 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 comprehensive 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 and environmental health at lower costs. The various industry segments bridge ideological gaps to develop balanced policies that benefit the entire industry.

Contact :

Indian Green Building Council
C/o Confederation of Indian Industry
CII – Sohrabji Godrej Green Business Centre
Survey No. 64, Kothaguda Post
Near Kothaguda Cross Roads, R R Dist
Hyderabad – 500 084

Introduction

I. Why Make your Building Green?

The environmental impact of the building design, construction and operation industry is significant. Buildings annually consume more than 20% of the electricity used in India.

Development shifts land usage away from natural, biologically-diverse habitats to hardscape that is impervious and devoid of biodiversity. The far reaching influence of the built environment necessitates action to reduce its impact.

Green building practices can substantially reduce or eliminate negative environmental impacts and improve existing unsustainable design, construction and operational practices. As an added benefit, green design measures reduce operating costs, enhance building marketability, increase worker productivity and reduce potential liability resulting from indoor air quality problems.

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. In other words, green building design has environmental, economic and social elements that benefit all building stakeholders, including owners, occupants and the general public.

II. LEED Green Building Rating System

A. History of LEED in India

Following the formation of the Indian Green Building Council (IGBC) in 2001, the membership quickly realised that one of the priorities for the sustainable building industry was to have a system to define and measure "green buildings".

Since the CII-Godrej GBC achieved the prestigious LEED rating for its own centre at Hyderabad in 2003, the Green building movement has gained tremendous momentum. The Platinum rating awarded for this building sparked off considerable enthusiasm in the country.

From a humble beginning of 20,000 sq.ft of green footprint in the country in the year 2003, to a staggering 600 million sq.ft by end 2010, green buildings are well poised to reach stellar heights. Today a variety of LEED rated green building projects are coming up in the country – hotels, exhibition centers, hospitals, educational institutions, laboratories, IT parks, airports, government buildings and corporate offices.

The IGBC set up the LEED 2011 for India Core Committee to focus on indigenising the LEED rating to suit the Indian context. The composition of the committee included architects, engineers, building owners, developers, manufacturers and industry representatives. This cross section of people and professions added a richness and depth both to the process and to the ultimate product.

The first LEED India rating programme, referred to as LEED India Version 1.0, was launched during the Green Building Congress Conference in October 2006. The latest rating system is now called the LEED 2011 for India - New Commercial Construction and Major Renovations or LEED 2011 for India - NC.

B. Features of LEED India

The LEED 2011 for India Green Building Rating System is a voluntary, consensus – based, market-driven building rating system based on existing proven technology. It evaluates environmental performance from a whole building perspective over a building's life cycle, providing a definitive standard for what constitutes a "green building".

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. Regional bonus points are another feature of LEED 2011 for India and acknowledge the importance of local conditions in determining best environmental design and construction practices.

LEED India for 2011 is a measurement system designed for rating new and existing commercial and institutional and residential buildings. It is based on accepted energy and environmental principles and strikes a balance between known established practices and emerging concepts.

It is a performance-oriented system where credits are earned for satisfying criterion designed to address specific environmental impacts inherent in the design and construction. Different levels of green building certification are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

C. The Future of LEED India for 2011

The green design field is growing and changing daily. New technologies and products are coming into the marketplace and innovative designs are proving their effectiveness. Therefore, the Rating System and the Reference Guide will evolve as well. Teams wishing to certify with LEED should note that they will need to comply with the version of the rating system that is current at the time of their registration.

The IGBC will highlight new developments on its website on a continuous basis at www.igbc.in

III. LEED 2011 for India - Overview and Process

The LEED 2011 for India - New Commercial Construction and Major Renovation (LEED 2011 for India - NC) provides a set of performance standards for certifying the design and construction phases of commercial and institutional buildings and high-rise residential buildings.

The specific credits in the rating system provide guidelines for the design and construction of buildings of all sizes in both the public and private sectors. The intent of LEED 2011 for India is to assist in the creation of high performance, healthful, durable, affordable and environmentally sound commercial and institutional buildings.

LEED 2011 for India - NC addresses:

- Sustainable Sites
- Water Efficiency
- Energy & Atmosphere
- Materials & Resources
- Indoor Environmental Quality
- Innovation in Design
- Regional Priority

A. When to use LEED 2011 for India - NC

LEED 2011 for India - NC is designed primarily for new commercial office buildings, but it can be applied to many other building types by LEED practitioners. All commercial buildings, as defined by standard building codes are eligible for certification as a LEED 2011 for India - NC Building. Commercial occupancies include (but are not limited to) offices, retail & service establishments, institutional buildings (libraries, schools, museums, places of worship, etc.,), hotels and residential buildings of four or more habitable stories.

LEED 2011 for India -NC addresses design and construction activities for both new buildings and major renovations of existing buildings. As a general rule-of- thumb, a major renovation involves elements of major HVAC renovation, significant envelope modifications and major interior rehabilitation.

Some projects are designed and constructed to be partially occupied by the owner or developer, and partially occupied by other tenants. In such projects, the owner or developer has direct influence over the portion of the work that they occupy. For such a project to pursue LEED 2011 for India - New Construction certification, the owner or tenant must occupy more than 50% of the building's leasable square footage. Projects in which 50% or less of the building's leasable square footage is occupied by an owner should pursue LEED 2011 for India - Core & Shell certification.

Many projects will cleanly and clearly fit the defined scope of only one LEED Rating System product. Other projects may be applicable to two or more LEED Rating System product scopes. IGBC encourages the project team to tally a potential point total using the Rating System checklists for all possibilities. The project is a viable candidate for LEED certification if it can meet all prerequisites and achieve the minimum points required in a given Rating System. If more than one Rating System applies, then it is up to the project team to decide which one to pursue. For assistance in choosing the most appropriate LEED Rating System, please e-mail at igbc@cii.in.

B. LEED 2011 for India NC Registration

Project teams interested in obtaining LEED 2011 for India NC Certification for their project must first register this intent with the IGBC. Projects can be registered on the IGBC website (www.igbc.in) under 'Register Your Project'. The website includes information on registration costs for IGBC member companies as well as non-members. Registration is an important step that establishes contact with the IGBC and provides access to software tools, errata, critical communications and other essential information.

C. Credit Interpretation Rulings

In some cases, the design team may encounter challenges in applying a LEED 2011 for India NC prerequisite or credit to their particular project. These difficulties arise from instances where the Reference Guide does not sufficiently address a specific issue or there is a special conflict that requires resolution.

IGBC will establish 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 CIR Web page for previously logged CIRs on relevant credits. All LEED 2011 for India NC 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. The CIR should be succinct and based on information found in the Reference Guide, with emphasis on the intent of the prerequisite or credit. Only registered projects are eligible to post 2 free CIRs

D. Applying for LEED 2011 for India Rating:

Consult the Web site for important details about applying the LEED 2011 for India application as well as the certification review process, schedule and fees. The project must satisfactorily document achievement all of the prerequisites and a minimum number of points to attain the LEED ratings as listed below.

LEED 2011 for India Certification Levels

Certified	**40-49 points**
Silver	**50-59 points**
Gold	**60-79 points**
Platinum	**80 points and above**

E. LEED 2011 for India Process

Once a project is registered, the project design team begins to collect information and perform calculations to satisfy the prerequisite and credit submittal requirements. Since submittal documentation should be gathered throughout design and construction, it is helpful to designate a LEED team leader who is responsible for managing the compilation of this information by the project team. Use the Letter Template that are provided through the LEED project resources webpage located in the LEED section of the IGBC website. These templates contain embedded calculators and are instrumental in documenting fulfillment of credit requirements and prompting for correct and complete supporting information.

F. Documentation

Once a project is registered, the project team begins to prepare documentation to satisfy the prerequisite and credit submittal requirements. This documentation will become the bulk of the project's LEED 2011 for India submission. It is helpful to have a LEED Accredited Professional as the project contact and team member responsible for coordinating the certification process.

Documentation is submitted in two phases – Preliminary and Final. Once the preliminary documentation is submitted the review team would provide review comments within 30 working days. Additional documentation along with clarifications to the queries posed in the preliminary review is submitted to IGBC for final review.The final review will also take 30 days, after which the rating is awarded.

LEED 2011 for India submittal resources consist of the Welcome Packet, Calculator (spreadsheets) and Letter 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. For example, full building commissioning reports may not be necessary because only the commissioning plan is required.

The LEED 2011 for India Application Template is a dynamic tracking and documentation tool that is used by project teams to track progress and prepare LEED documentation. For each credit, the Letter Template prompts LEED practitioners for summary data and signed declaration of performance, indicates when documentation requirements have been adequately fulfilled for submittal, serves as a letter template for printing on letterhead and summarises progress. Some of the template pages include spreadsheets for calculations, while others are simple declarations signed by an appropriate team member. The calculator spreadsheets are often useful when the Reference Guide calls for credit calculations but no corresponding spreadsheet exist in the Version.

During review, the project term 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, cut-sheets, manufacturer's literature and other source documents that were used as a basis to justify declaration of performance in the Letter Template. Many of these items are implicitly described in the Reference Guide's instructions.

Fee

Certification fee information can be found IGBC website. The IGBC will acknowledge receipt of your application and proceed with review when all project documentation has been submitted.

The LEED India NC ratings are awarded according to the following scale—

- Certified 40–49 points
- Silver 50–59 points
- Gold 60–79 points
- Platinum 80 points and above

The IGBC will recognize buildings that achieve one of these rating levels with a formal letter of certification and a mountable plaque.

G. L E E D 2011 for India Reference Guide

The LEED 2011 for India Reference Guide is a supporting document to the Rating System. The guide is intended to assist project teams in understanding the rating system and the benefits of complying with each criterion. The guide includes examples of strategies that can be used in each category, case studies of buildings that have implemented these strategies successfully and additional resources that will provide more information. The guide does not provide an exhausting list of strategies for meeting the criteria as subsequent strategies will be developed and employed by designers that satisfy the intent of each credit. 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 is organised in a standardised format for simplicity and quick reference. The first section summarises the key points regarding the measure and includes the intent, requirements and some potential technologies & strategies for achieving the credit. The subsequent sections provide supportive information to help interpret the measure, example and links to various resources.

Updates & Addenda

This is the latest edition of the LEED India Rating System, dated February 2011. As the rating system continues to improve and evolve, updates and addenda will be made available to substitute and augment the current material. Updates and addenda will be formally incorporated in major revisions. In the interim between major revisions, the IGBC may use its consensus process to clarify criteria.

When a project registers for certification, the prerequisites, credits and credit rulings current at the time of project registration will continue to guide the project through its certification processes.

SUSTAINABLE SITES

SS Prerequisite 1: Construction Activity Pollution Prevention

Required

Intent

To reduce pollution from construction activities by controlling soil erosion, waterway sedimentation and airborne dust generation.

Requirements

Create and implement an erosion and sedimentation control plan for all construction activities associated with the project. The plan must conform to erosion and sedimentation control requirements of Local Standards and Codes **(OR)** National Building Code of India (NBC), Part 10, Section 1, Chapters 4 & 5, whichever is more stringent.

The plan must describe the measures implemented to accomplish the following objectives:

- To prevent loss of soil during construction by stormwater runoff and/or wind erosion, including protecting topsoil by stockpiling for reuse.
- To prevent sedimentation of storm sewers or receiving streams.
- To prevent pollution of the air with dust and particulate matter.

Potential Technologies & Strategies

Create an erosion and sedimentation control plan during the design phase of the project. Consider employing strategies such as temporary and permanent seeding, mulching, earthen dikes, silt fencing, sediment traps and sediment basins.

Summary of Referenced Standard

National Building Codes of India (NBC) Part 10, section 1, chapter 4 – Protection of Landscape during Construction and chapter 5 - Soil and Water Conservation.

This standard describes two types of measures that can be used to control sedimentation and erosion. Stabilization measures include temporary seeding, permanent seeding and mulching. All of these measures are intended to stabilize the soil to prevent erosion. Structural control measures are implemented to retain sediment after erosion has occurred. Structural control measures include earth dikes, silt fencing, sediment traps and sediment basins. The application of these measures depends on the conditions at the specific site. If local provisions are substantially similar, they can be substituted for this standard if it is demonstrated that local provisions meet or exceed NBC best management practices.

SS Credit 1: Site Selection

1 Point

Intent

To avoid the development of inappropriate sites and reduce the environmental impact from the location of a building on a site.

Requirements

Do not develop buildings, hardscape, roads or parking areas on portions of sites that meet any of the following criteria:

- High-value farmland as defined by the relevant local, regional, state or central government agency.
- Previously undeveloped land within areas classified at high or very high hydrogeologic risk, including any land whose elevation is lower than 5 feet (1.5 meters) above the elevation of the 100-year flood, as defined by the relevant local, regional, state or central government agency.
- Land specifically identified as habitat for any species listed as threatened or endangered by Wildlife Institute of India.
- Land within 100 feet (30 meters) of a wetland listed as being of high ecological value by the relevant local, regional, state, or central government agency. Renovation of an existing building is allowed if construction impact is limited to the existing development footprint.
- Previously undeveloped land that is within 50 feet (15 meters) of a water body that supports or could support aquatic life, recreation or industrial use, as determined by a professional biologist.
- Land that prior to acquisition for the project was public parkland.

Potential Technologies & Strategies

During the site selection process, give preference to sites that do not include sensitive elements or restrictive land types. Select a suitable building location and design the building with a minimal footprint to minimize disruption of the environmentally sensitive areas identified above.

SS Credit 2: Development Density and Community Connectivity

5 Points

Intent

To channel development to urban areas with existing infrastructure, protect greenfields, and preserve habitat and natural resources.

Requirements

This credit will be made available for public use shortly.

Potential Technologies & Strategies

During the site selection process, give preference to urban sites with pedestrian access to a variety of services.

SS Credit 3: Brownfield Redevelopment

1 Point

Intent

To rehabilitate damaged sites where development is complicated by environmental contamination and to reduce pressure on undeveloped land.

Requirements

OPTION 1

Develop on a site documented as contaminated (by means of an ASTM E1903-97 Phase II Environmental Site Assessment or a local voluntary cleanup program).

OR

OPTION 2

Develop on a site defined as a brownfield by a local, state, or central government agency.

For projects where asbestos is found and remediated also earn this credit. Testing should be done in accordance with EPA Reg 40CFR part 763, (OR) a local, state, or central government agency when applicable.

OR

OPTION 3

Develop on a site where the risk of contamination has been determined via relevant local, state or central contamination risk protocols. Where site contamination was identified, demonstrate that site remediation was completed according to the relevant local, state or central requirements.

Potential Technologies & Strategies

During the site selection process, give preference to brownfield sites. Identify tax incentives and property cost savings. Coordinate site development plans with remediation activity, as appropriate.

Summary of Referenced Standards

ASTM E1903-97 Phase II Environmental Site Assessment, ASTM International, www.astm.org

This guide covers a framework for employing good commercial and customary practices in conducting a Phase II environmental site assessment of a parcel of a commercial property.

Brownfield Definition

With certain legal exclusions and additions, the term “brownfield site” means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant or contaminant.

SS Credit 4.1: Alternative Transportation—Public Transportation Access

6 Points

Intent

To reduce pollution and land development impacts from automobile use.

Requirements

OPTION 1. Rail Station Proximity

Locate the project within 1/2-mile (800-meter) walking distance (measured from a main building entrance) of an existing or planned and funded commuter rail, light rail or subway station.

OR

OPTION 2. Bus Stop Proximity

Locate the project within 1/4-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for 2 or more public, campus, or private bus lines usable by building occupants.

OR

OPTION 3. Public Transportation Proximity

Locate the project within ¼-mile (400-meter) walking distance (measured from a main building entrance) of 1 or more stops for at least 2 rideshare options for 4 or more passengers. Rideshare options include passenger ferry terminals, vans and human-powered conveyances, such as rickshaws, that are authorized by the local transit authority and that meet the definition of public transportation.

Potential Technologies & Strategies

Perform a transportation survey of future building occupants to identify transportation needs. Locate the building near mass transit.

SS Credit 4.2: Alternative Transportation—Bicycle Storage and Changing Rooms

1 Point

Intent

To reduce pollution and land development impacts from automobile use.

Requirements

CASE 1. Commercial or Institutional Projects

- Provide secure bicycle racks and/or storage within 200 yards (200 meters) of a building entrance for 5% or more of all building users (measured at peak periods)
- Provide shower and changing facilities in the building, or within 200 yards (200 meters) of a building entrance, for 0.5% of full-time equivalent (FTE) occupants.

CASE 2. Residential Projects

- Provide covered storage facilities for securing bicycles for 15% or more of building occupants.

Potential Technologies & Strategies

Design the building with transportation amenities such as bicycle racks and shower/changing facilities.

SS Credit 4.3: Alternative Transportation—Low-Emitting and Fuel-Efficient Vehicles

3 Points

Intent

To reduce pollution and land development impacts from automobile use.

Requirements

OPTION 1

Provide preferred parking[1] for low-emitting and fuel-efficient vehicles[2] for 5% of the total vehicle parking capacity of the site. Providing a discounted parking rate is an acceptable substitute for preferred parking for low-emitting/fuel-efficient vehicles. To establish a meaningful incentive in all potential markets, the parking rate must be discounted at least 20%. The discounted rate must be available to all customers (i.e., not limited to the number of customers equal to 5% of the vehicle parking capacity), publicly posted at the entrance of the parking area and available for a minimum of 2 years.

OR

OPTION 2

Install alternative-fuel fueling stations for 3% of the total vehicle parking capacity of the site. Liquid or gaseous fueling facilities must be separately ventilated or located outdoors.

OR

OPTION 3

Provide low-emitting and fuel-efficient vehicles[2] for 3% of full-time equivalent (FTE) occupants.

Provide preferred parking[1] for these vehicles.

OR

OPTION 4

Provide building occupants access to a low-emitting or fuel-efficient vehicle-sharing program. The following requirements must be met:

- One low-emitting or fuel-efficient vehicle must be provided per 3% of FTE occupants, assuming that
  1 shared vehicle can carry 8 persons (i.e., 1 vehicle per 267 FTE occupants). For buildings with fewer than 267 FTE occupants, at least 1 low emitting or fuel-efficient vehicle must be provided.
- A vehicle-sharing contract must be provided that has an agreement of at least 2 years.
- The estimated number of customers served per vehicle must be supported by documentation.
- A narrative explaining the vehicle-sharing program and its administration must be submitted.

---

[1] For the purposes of this credit "preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped persons) or parking passes provided at a discounted price.

[2] For the purposes of this credit, low-emitting and fuel-efficient vehicles are defined as vehicles that are either classified as Zero Emission Vehicles (ZEV) by a local authority

- Parking for low-emitting and fuel-efficient vehicles must be located in the nearest available spaces in the nearest available parking area. Provide a site plan or area map clearly highlighting the walking path from the parking area to the project site and noting the distance.

Potential Technologies & Strategies

Provide transportation amenities such as alternative-fuel refueling stations. Consider sharing the costs and benefits of refueling stations with neighbors.

SS Credit 4.4: Alternative Transportation—Parking Capacity

2 Points

Intent

To reduce pollution and land development impacts from automobile use.

Requirements

NOTE:

1. The term '2-wheeler' in this credit refers to an engine-powered passenger vehicle that runs on two wheels, and is authorized by regulation to seat a maximum of 2 persons, *viz* the driver and pillion rider. Scooters, motorcycles, mopeds, etc., come under this definition. Such 2-wheelers, if they have a side car attached, would also be considered as a 2-wheeler (such vehicles in India can be accommodated within the dimensions of regular 2-wheeler parking slots). Bicycles pedaled by manual power are not included under this definition.
2. 2-wheeler pooling is defined as the shared use of one 2-wheeler by two different individuals – for the purpose of reducing vehicular fuel consumption, and vehicular pollution.
3. Car pooling is defined as the shared use of one car by a number of different individuals – upto the maximum permissible capacity of the car (typically 5, including the driver) – for the purpose of reducing vehicular fuel consumption, and vehicular pollution. Similarly, van pooling is defined as the shared use of a passenger transport vehicle having higher capacity than cars (typically seating 7 or more persons) – which is generally arranged by the company or employer, for employees to commute from specific pickup points to the place of work, and *vice versa*.
4. For all cases under this credit, the ratio of preferred parking allocation between pooled 4-wheelers and pooled 2-wheelers should be the same as the ratio for total parking specified by the NBC or Local Regulation for 4-wheelers *vs* 2-wheelers.

CASE 1. Non-Residential Projects

OPTION 1

Size parking capacity to meet, but not exceed, minimum Local Regulations (OR) the National Building Code of India (NBC), and provide preferred parking for Carpools / Vanpools and Bikepools, capable of serving 5% of the total provided parking spaces, for 4-wheelers & 2-wheelers.

OR

OPTION 2

For projects that provide parking for less than 5% of full-time equivalent (FTE) building occupants:

Provide preferred parking[3] for carpools or vanpools, marked as such, for 5% of total parking spaces. Providing a discounted parking rate is an acceptable substitute for preferred parking for carpool or vanpool vehicles. To establish a meaningful incentive in all potential markets, the parking rate must be discounted at least 20%. The discounted rate must be available to all customers (i.e., not limited to the number of customers equal to 5% of the vehicle parking capacity), publicly posted at the entrance of the parking area, and available for a minimum of 2 years.

[3] For the purposes of this credit "preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped persons) or parking passes provided at a discounted price.

OR

OPTION 3

Provide no new parking.

OR

OPTION 4

For projects that have no minimum local zoning requirements, provide 25% fewer parking spaces than the applicable standard listed in the 2003 Institute of Transportation Engineers (ITE) "Parking Generation" study at http://www.ite.org.

CASE 2. Residential Projects

OPTION 1

Size parking capacity to meet but not exceed minimum local zoning requirements

Provide infrastructure and support programs to facilitate shared vehicle use such as carpool drop-off areas, designated parking for vanpools, car-share services, ride boards and shuttle services to mass transit.

OR

OPTION 2

Provide no new parking.

CASE 3. Mixed Use (Residential with Commercial/Retail) Projects

OPTION 1

Mixed-use buildings with less than 10% commercial area must be considered residential and adhere to the residential requirements in Case 2. For mixed-use buildings with more than 10% commercial area, the commercial space must adhere to non-residential requirements in Case 1 and the residential component must adhere to residential requirements in Case 2

OR

OPTION 2

Provide no new parking.

Potential Technologies & Strategies

Minimize parking lot/garage size. Consider sharing parking facilities with adjacent buildings. Consider alternatives that will limit the use of single occupancy vehicles.

Perform a transportation survey of future building occupants to identify transportation needs. Site the building near mass transit and design the building with transportation amenities such as alternative fuel refueling stations. Also consider sharing the cost and benefits of refueling stations with neighbors. Minimize the parking lot/garage size. Consider sharing parking facilities with adjacent buildings and alternatives that will limit the use of single occupied vehicles.

Due to wide usage of 2-wheelers, preferred parking should encourage pooling of 2-wheelers as well. The general proportion to be followed between 4-wheelers and 2-wheelers while providing total parking is already specified by local regulations. Project teams should use the same proportion in calculating preferred parking to 4-wheelers and 2-wheelers.

Example: Let us say the total parking capacity as per Local Regulations or NBC works out to be 100 slots. And, say that local regulation prescribes 2:3 as the parking ratio between 4-wheelers & 2-wheelers. Then the total number of slots to be allocated for 4-wheelers would be 40, and for 2-wheelers it would be 60 slots. Accordingly, the number of *preferred parking* slots to be allocated for 4-wheeler pooling would be 5% of 40, or 2 slots. And the number of *preferred parking* slots for 2-wheeler pooling would be 5% of 60, or 3 slots.

SS Credit 5.1: Site Development—Protect or Restore Habitat

1 Point

Intent

To conserve existing natural areas and restore damaged areas to provide habitat and promote biodiversity.

Requirements

CASE 1. Greenfield Sites[4]

Limit all site disturbance to the following parameters:

- 40 feet (12 meters) beyond the building perimeter;
- 10 feet (3 meters) beyond surface walkways, patios, surface parking and utilities less than 12 inches (30 centimeters) in diameter;
- 15 feet (4.5 meters) beyond primary roadway curbs and main utility branch trenches;
- 25 feet (8 meters) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities and playing fields) that require additional staging areas to limit compaction in the constructed area.

CASE 2. Previously Developed[5] Areas or Graded Sites

Restore or protect a minimum of 50% of the site (excluding the building footprint) or 20% of the total site area (including building footprint), whichever is greater, with native or adapted vegetation[6]. Projects earning SS Credit 2: Development Density and Community Connectivity may include vegetated roof surface in this calculation if the plants are native or adapted, provide habitat, and promote biodiversity.

Potential Technologies & Strategies

Survey greenfield sites to identify site elements and adopt a master plan for developing the project site. Carefully site the building to minimize disruption to existing ecosystems and design the building to minimize its footprint. Strategies include stacking the building program, tuck-under parking and sharing parking facilities with neighbors. Establish clearly-marked construction boundaries to minimize disturbance of the existing site and restore previously degraded areas to their natural state. For previously developed sites, use local and regional governmental agencies, consultants, educational facilities and native plant societies as resources for the selection of appropriate native or adapted plants. Prohibit plants listed as invasive or noxious weed species. Once established, native/adapted plants require minimal or no irrigation; do not require active maintenance such as mowing or chemical inputs such as fertilizers, pesticides or herbicides; and provide habitat value and promote biodiversity through avoidance of monoculture plantings.

---

[4] Greenfield sites are those that are not previously developed or graded and remain in a natural state. Rural landscapes are considered the same as greenfield sites. A rural landscape is a natural area modified by agro-forestry-pastoral activities, with environmental, aesthetic, cultural and historical values resulting from the interrelationship between its physical and biological aspects and traditional human activities.

[5] Previously developed areas are those that previously contained buildings, roadways, parking lots or were graded or altered by direct human activities.

[6] Native or adapted plants are plants indigenous to a locality or cultivars of native plants that are adapted to the local climate and are not considered invasive species or noxious weeds.

SS Credit 5.2: Site Development—Maximize Open Space

1 Point

Intent

To promote biodiversity by providing a high ratio of open space to development footprint.

Requirements

CASE 1. Sites with Local Zoning Open Space Requirements

Reduce the development footprint[7] and/or provide vegetated open space within the project boundary such that the amount of open space exceeds local zoning requirements by 25%.

CASE 2. Sites with No Local Zoning Requirements (e.g. some university campuses, military bases)

Provide a vegetated open space area adjacent to the building that is equal in area to the building footprint.

CASE 3. Sites with Zoning Ordinances but No Open Space Requirements

Provide vegetated open space equal to 20% of the project site area.

ALL CASES

For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, vegetated roof areas can contribute to credit compliance.

For projects in urban areas that earn SS Credit 2: Development Density and Community Connectivity, pedestrian-oriented hardscape areas can contribute to credit compliance. For such projects, a minimum of 25% of the open space counted must be vegetated.

Wetlands or naturally designed ponds may count as open space and the side slope gradients average 1:4 (vertical: horizontal) or less and are vegetated.

Potential Technologies & Strategies

Perform a site survey to identify site elements and adopt a master plan for developing the project site. Select a suitable building location and design the building footprint to minimize site disruption. Strategies include stacking the building program, tuck-under parking and sharing parking facilities with neighbors to maximize the amount of open space on the site.

[7] Development footprint is defined as the total area of the building footprint, hardscape, access roads and parking.

SS Credit 6.1: Stormwater Design—Quantity Control

1 Point

Intent

To limit disruption of natural hydrology by reducing impervious cover, increasing on-site infiltration, reducing or eliminating pollution from stormwater runoff and eliminating contaminants.

Requirements

CASE 1. Sites with Existing Imperviousness 50% or Less

Implement a stormwater management plan that prevents the post-development peak discharge quantity from exceeding the predevelopment discharge quantity calculated based upon a 24-hour rainfall that is equal to 30% of the average rainfall for the month with the highest average rainfall.

CASE 2. Sites with Existing Imperviousness Greater Than 50%

Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff calculated based upon a 24-hour rainfall that is equal to 30% of the average rainfall for the month with the highest average rainfall.

Potential Technologies & Strategies

Design the project site to maintain natural stormwater flows by promoting infiltration. Specify vegetated roofs, pervious paving and other measures to minimize impervious surfaces. Reuse stormwater for non-potable uses such as landscape irrigation, toilet and urinal flushing, and custodial uses.

SS Credit 6.2: Stormwater Design—Quality Control

1 Point

Intent

To limit disruption and pollution of natural water flows by managing stormwater runoff.

Requirements

Implement a stormwater management plan that reduces impervious cover, promotes infiltration and captures and treats the stormwater runoff from 90% of the average annual rainfall using acceptable best management practices (BMPs).

BMPs used to treat runoff must be capable of removing 80% of the average annual post-development total suspended solids (TSS) load based on existing monitoring reports.

Potential Technologies & Strategies

Use alternative surfaces (e.g., vegetated roofs, pervious pavement, grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration and thereby reduce pollutant loadings.

Use sustainable design strategies (e.g., low-impact development, environmentally sensitive design) to create integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters and open channels to treat stormwater runoff.

SS Credit 7.1: Heat Island Effect—Nonroof

1 Point

Intent

To reduce heat islands[8] to minimize impacts on microclimates and human and wildlife habitats.

Requirements

NOTE:

For each option below, if SRI information is not available for the specified product, demonstrate compliance using the SRI calculator in California's Energy Efficiency Standards for Residential and Nonresidential Buildings (California Code of Regulations, Title 24, Part 6; available at http://www.energy.ca.gov/title24/2008standards/sri_calculator/SRI_Calculator_Worksheet.pdf). This calculator uses solar reflectance and thermal emittance to determine the SRI of roofing materials.

OPTION 1

Use any combination of the following strategies for 50% of the site hardscape (including roads, sidewalks, courtyards and parking lots):

- Provide shade from the existing tree canopy or within 5 years of landscape installation. Landscaping (trees) must be in place at the time of occupancy.
- Provide shade from structures covered by solar panels that produce energy used to offset some nonrenewable resource use.
- Provide shade from architectural devices or structures that have a solar reflectance index[9] (SRI) of at least 29.
- Use hardscape materials with an SRI of at least 29.
- Use an open-grid pavement system (at least 50% pervious).

OR

OPTION 2

Place a minimum of 50% of parking spaces under cover[10]. Any roof used to shade or cover parking must have an SRI of at least 29, be a vegetated green roof or be covered by solar panels that produce energy used to offset some nonrenewable resource use.

Potential Technologies & Strategies

Employ strategies, materials and landscaping techniques that reduce the heat absorption of exterior materials. Use shade (calculated on June 21, noon solar time) from native or adapted trees and large shrubs, vegetated trellises or other exterior structures supporting vegetation. Consider using new coatings and integral colorants for asphalt to achieve light-colored surfaces instead of blacktop. Position photovoltaic cells to shade impervious surfaces.

---

[8] Heat islands are defined as thermal gradient differences between developed and undeveloped areas.

[9] The solar reflectance index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918, or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

[10] For the purposes of this credit, under cover parking is defined as parking underground, under deck, under roof, or under a building.

Consider replacing constructed surfaces (e.g., roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials, such as concrete, to reduce heat absorption.

SS Credit 7.2: Heat Island Effect—Roof

1 Point

Intent

To reduce heat islands[11] to minimize impacts on microclimates and human and wildlife habitats.

Requirements

NOTE:

For each option below, if SRI information is not available for the specified product, demonstrate compliance using the SRI calculator in California's Energy Efficiency Standards for Residential and Nonresidential Buildings (California Code of Regulations, Title 24, Part 6; available at http://www.energy.ca.gov/title24/2008standards/sri_calculator/SRI_Calculator_Worksheet.pdf). This calculator uses solar reflectance and thermal emittance to determine the SRI of roofing materials.

OPTION 1

Use roofing materials with a solar reflectance index[12] (SRI) equal to or greater than the values in the table below for a minimum of 75% of the roof surface.

Roofing materials having a lower SRI value than those listed below may be used if the weighted rooftop SRI average meets the following criteria:

$$\frac{\text{Area Roof Meeting Minimum SRI}}{\text{Total Roof Area}} \times \frac{\text{SRI of Installed Roof}}{\text{Required SRI}} \geq 75\%$$

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

OR

OPTION 2

Install a vegetated roof that covers at least 50% of the roof area.

OR

[11] Heat islands are defined as thermal gradient differences between developed and undeveloped areas.

[12] The solar reflectance index (SRI) is a measure of the constructed surface's ability to reflect solar heat, as shown by a small temperature rise. It is defined so that a standard black surface (reflectance 0.05, emittance 0.90) is 0 and a standard white surface (reflectance 0.80, emittance 0.90) is 100. To calculate the SRI for a given material, obtain the reflectance value and emittance value for the material. SRI is calculated according to ASTM E 1980. Reflectance is measured according to ASTM E 903, ASTM E 1918 or ASTM C 1549. Emittance is measured according to ASTM E 408 or ASTM C 1371.

OPTION 3

Install high-albedo and vegetated roof surfaces that, in combination, meet the following criteria:

$$\frac{\text{Area Roof Meeting Minimum SRI}}{0.75} + \frac{\text{Area of Vegetated Roof}}{0.5} \geq \text{Total Roof Area}$$

Roof Type	Slope	SRI
Low-sloped roof	≤ 2:12 (15%)	78
Steep-sloped roof	> 2:12 (15%)	29

Potential Technologies & Strategies

Consider installing high-albedo and vegetated roofs to reduce heat absorption. Default values will be available in the LEED 2011 Reference Guide for Green Building Design and Construction. Product information is available from the Cool Roof Rating Council Web site at http://www.coolroofs.org/

SS Credit 8: Light Pollution Reduction

1 Point

Intent

To minimize light trespass from the building and site, reduce sky-glow to increase night sky access, improve nighttime visibility through glare reduction and reduce development impact from lighting on nocturnal environments.

Requirements

Project teams must comply with 1 of the 2 options for interior lighting **(AND)** the requirement for exterior lighting.

For Interior Lighting

OPTION 1

Reduce the input power (by automatic device) of all nonemergency interior luminaires with a direct line of sight to any openings in the envelope (translucent or transparent) by at least 50% between 11 p.m. and 5 a.m. After-hours override may be provided by a manual or occupant-sensing device provided the override lasts no more than 30 minutes.

OR

OPTION 2

All openings in the envelope (translucent or transparent) with a direct line of sight to any nonemergency luminaires must have shielding (controlled/closed by automatic device for a resultant transmittance of less than 10% between 11 p.m. and 5 a.m.).

For Exterior Lighting

Light areas only as required for safety and comfort. Exterior lighting power densities shall not exceed those specified in ANSI/ASHRAE/IESNA Standard 90.1-2007 with Addenda 1 for the documented lighting zone. Justification shall be provided for the selected lighting zone. Lighting controls for all exterior lighting shall comply with section 9.4.1.3 of ANSI/ASHRAE/IESNA Standard 90.1- 2007, without amendments[13].

Classify the project under one of the following zones, as defined in IESNA RP-33, and follow all the requirements for that zone:

LZ1: Dark (developed areas within national parks, state parks, forest land and rural areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.01 horizontal and vertical footcandles (0.1 horizontal and vertical lux) at the site boundary and beyond. Document that 0% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2: Low (primarily residential zones, neighborhood business districts, light industrial areas with limited nighttime use and residential mixed-use areas)

[13] The requirement to use ASHRAE Addenda I is unique to this credit and does not obligate Project teams to use ASHRAE approved addenda for other credits.

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.10 horizontal and vertical footcandles (1.0 horizontal and vertical lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 10 feet (3 meters) beyond the site boundary. Document that no more than 2% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ3: Medium (all other areas not included in LZ1, LZ2 or LZ4, such as commercial/ industrial, and high-density residential)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.20 horizontal and vertical footcandles (2.0 horizontal and vertical lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 15 feet (4.5 meters) beyond the site. Document that no more than 5% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ4: High[14] (high-activity commercial districts in major metropolitan areas)

Design exterior lighting so that all site and building-mounted luminaires produce a maximum initial illuminance value no greater than 0.60 horizontal and vertical footcandles (6.5 horizontal and vertical lux) at the site boundary and no greater than 0.01 horizontal footcandles (0.1 horizontal lux) 15 feet (4.5 meters) beyond the site. Document that no more than 10% of the total initial designed fixture lumens (sum total of all fixtures on site) are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2, LZ3 and LZ4 - For site boundaries that abut public rights-of-way, light trespass requirements may be met relative to the curb line instead of the site boundary.

For All Zones

Illuminance generated from a single luminaire placed at the intersection of a private vehicular driveway and public roadway accessing the site is allowed to use the centerline of the public roadway as the site boundary for a length of 2 times the driveway width centered at the centerline of the driveway.

Potential Technologies & Strategies

Adopt site lighting criteria to maintain safe light levels while avoiding off-site lighting and night sky pollution. Minimize site lighting where possible, and use computer software to model the site lighting. Technologies to reduce light pollution include full cutoff luminaires, low-reflectance surfaces and low-angle spotlights.

[14] To be LZ4, the area must be so designated by an organization with local jurisdiction, such as the local zoning authority.

WATER EFFICIENCY

WE Prerequisite 1: Water Use Reduction

Required

Intent

To increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirements

Employ strategies that in aggregate use 20% less water than the water use baseline calculated for the building (not including irrigation).

Calculate the baseline according to the commercial and/or residential baselines outlined below.[15] Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and prerinse spray valves.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf) Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Commercial prerinse spray valves (for food service applications)	Flow rate ≤ 1.6 (gpm) (no pressure specified; no performance requirement)	Flow rate ≤ 6.1 lpm (no pressure specified; no performance requirement)

Residential Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Residential toilets	1.6 (gpf)***	6 liters per flush (lpf) Except blow-out fixtures: 13 lpf
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	4 lpf 8.5 lpm at 4 bar (58 psi), private

[15] Tables adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

Residential Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Residential kitchen faucet		applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	Flow rate ≤ 6.1 lpm (no pressure specified; no performance requirement)

* EPAct 1992 standard for toilets applies to both commercial and residential models.

** In addition to EPAct requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (2.0 lpm at 4 bar (58 psi)) (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.

*** EPAct 1992 standard for toilets applies to both commercial and residential models.

**** Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches (1.5 square meters). For each increment of 2,500 square inches (1.5 square meters) of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers

Potential Technologies & Strategies

WaterSense-certified fixtures and fixture fittings should be used where available. Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce potable water demand. Consider using alternative on-site sources of water (e.g., rainwater, stormwater, and air conditioner condensate) and graywater for nonpotable applications such as custodial uses and toilet and urinal flushing. The quality of any alternative source of water used must be taken into consideration based on its application or use.

.

WE Credit 1: Water Efficient Landscaping

2–4 Points

Intent

To limit or eliminate the use of potable water or other natural surface or subsurface water resources available on or near the project site for landscape irrigation.

Requirements

OPTION 1. Reduce by 50% (2 points)

Reduce potable water consumption for irrigation by 50% from a calculated baseline case for the month with the highest evapotranspiration rate.

Reductions must be attributed to any combination of the following items:

- Plant species, density and microclimate factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for nonpotable uses

OR

OPTION 2. No Potable Water Use or Irrigation1 (4 points)

Meet the requirements for Option 1.

AND

PATH 1

Use only captured rainwater, recycled wastewater, recycled graywater or water treated and conveyed by a public agency specifically for nonpotable uses for irrigation.

OR

PATH 2

Install landscaping that does not require permanent irrigation systems. Temporary irrigation systems used for plant establishment are allowed only if removed within 1 year of installation.

Potential Technologies & Strategies

Perform a soil/climate analysis to determine appropriate plant material and design the landscape with native or adapted plants to reduce or eliminate irrigation requirements. Where irrigation is required, use high-efficiency equipment and/or climate-based controllers.

WE Credit 2: Innovative Wastewater Treatment and Reuse

2 Points

Intent

To reduce wastewater generation and potable water demand while increasing the local aquifer recharge.

Requirements

OPTION 1 (1 point):

Treat 100% of wastewater on-site to tertiary standards. Treated water must be used on-site

AND/OR

OPTION 2 (1point):

Use treated wastewater or captured rain water, to reduce potable water consumption for air- conditioning make-up by 50% (if the project uses water-cooled chillers); **(AND)** Reduce potable water use for building sewage conveyance by 50% through the use of non-potable water (e.g., treated wastewater, municipally treated wastewater, captured rainwater).

Potential Technologies & Strategies

Specify high-efficiency fixtures and dry fixtures (e.g., composting toilet systems, nonwater-using urinals) to reduce wastewater volumes. Consider reusing stormwater or graywater for sewage conveyance or on-site mechanical and/or natural wastewater treatment systems. Options for on-site wastewater treatment include packaged biological nutrient removal systems, constructed wetlands and high-efficiency filtration systems.

WE Credit 3: Water Use Reduction

2–4 Points

Intent

To further increase water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems.

Requirements

Employ strategies that in aggregate use less water than the water use baseline calculated for the building (not including irrigation). The minimum water savings percentage for each point threshold is as follows:

Percentage Reduction	Points
30%	2
35%	3
40%	4

Calculate the baseline according to the commercial and/or residential baselines outlined below.[16] Calculations are based on estimated occupant usage and must include only the following fixtures and fixture fittings (as applicable to the project scope): water closets, urinals, lavatory faucets, showers, kitchen sink faucets and pre-rinse spray valves.

Commercial Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Commercial toilets	1.6 gallons per flush (gpf)* Except blow-out fixtures: 3.5 (gpf)	6 liters per flush (lpf) Except blow-out fixtures: 13 lpf
Commercial urinals	1.0 (gpf)	4 lpf
Commercial lavatory (restroom) faucets	2.2 gallons per minute (gpm) at 60 pounds per square inch (psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 0.5 (gpm) at 60 (psi)** all others except private applications 0.25 gallons per cycle for metering faucets	8.5 liters per minute (lpm) at 4 bar (58 psi), private applications only (hotel or motel guest rooms, hospital patient rooms) 2.0 lpm at 4 bar (58 psi), all others except private applications 1 liter per cycle for metering faucets
Commercial prerinse spray valves (for food service applications)	Flow rate ≤ 1.6 (gpm) (no pressure specified; no performance requirement)	Flow rate ≤ 6.1 lpm (no pressure specified; no performance requirement)

[16] Tables adapted from information developed and summarized by the U.S. Environmental Protection Agency (EPA) Office of Water based on requirements of the Energy Policy Act (EPAct) of 1992 and subsequent rulings by the Department of Energy, requirements of the EPAct of 2005, and the plumbing code requirements as stated in the 2006 editions of the Uniform Plumbing Code or International Plumbing Code pertaining to fixture performance.

Residential Fixtures, Fittings, and Appliances	Current Baseline (Imperial units)	Current Baseline (Metric units)
Residential toilets	1.6 (gpf)***	6.1 liters per flush (lpf)
Residential lavatory (bathroom) faucets	2.2 (gpm) at 60 psi	8.5 lpm at 4 bar (58 psi)
Residential kitchen faucet		
Residential showerheads	2.5 (gpm) at 80 (psi) per shower stall****	9.5 lpm at 4 bar (58 psi)

* EPAct 1992 standard for toilets applies to both commercial and residential models.

** In addition to EPAct requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (2.0 lpm at 4 bar (58 psi))(ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code.

*** EPAct 1992 standard for toilets applies to both commercial and residential models.

**** Residential shower compartment (stall) in dwelling units: The total allowable flow rate from all flowing showerheads at any given time, including rain systems, waterfalls, bodysprays, bodyspas and jets, must be limited to the allowable showerhead flow rate as specified above (2.5 gpm) per shower compartment, where the floor area of the shower compartment is less than 2,500 square inches (1.5 square meters). For each increment of 2,500 square inches (1.5 square meters) of floor area thereafter or part thereof, an additional showerhead with total allowable flow rate from all flowing devices equal to or less than the allowable flow rate as specified above must be allowed. Exception: Showers that emit recirculated nonpotable water originating from within the shower compartment while operating are allowed to exceed the maximum as long as the total potable water flow does not exceed the flow rate as specified above.

The following fixtures, fittings and appliances are outside the scope of the water use reduction calculation:

- Commercial Steam Cookers
- Commercial Dishwashers
- Automatic Commercial Ice Makers
- Commercial (family-sized) Clothes Washers
- Residential Clothes Washers
- Standard and Compact Residential Dishwashers

Potential Technologies & Strategies

Use WaterSense-certified fixtures and fixture fittings where available. Use high-efficiency fixtures (e.g., water closets and urinals) and dry fixtures, such as toilets attached to composting systems, to reduce the potable water demand. Consider using alternative on-site sources of water (e.g., rainwater, stormwater, and air conditioner condensate, graywater) for nonpotable applications (e.g., toilet and urinal flushing, custodial uses). The quality of any alternative source of water being used must be taken into consideration based on its application or use.

ENERGY & ATMOSPHERE

EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems

Required

Intent

To verify that the project's energy-related systems are installed, and calibrated to perform according to the owner's project requirements, basis of design and construction documents.

Benefits of commissioning include reduced energy use, lower operating costs, fewer contractor callbacks, better building documentation, improved occupant productivity and verification that the systems perform in accordance with the owner's project requirements.

Requirements

The following commissioning process activities must be completed by the project team:

- Designate an individual as the commissioning authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
- The CxA must have documented commissioning authority experience in at least 2 building projects.
- The individual serving as the CxA must be independent of the project design and construction management, though the CxA may be an employee of any firm providing those services. The CxA may be a qualified employee or consultant of the owner.
- The CxA must report results, findings and recommendations directly to the owner.
- For projects smaller than 50,000 gross square feet (5,000 gross square meters), the CxA may be a qualified person on the design or construction team who has the required experience.
- The owner must document the owner's project requirements. The design team must develop the basis of design. The CxA must review these documents for clarity and completeness. The owner and design team must be responsible for updates to their respective documents.
- Develop and incorporate commissioning requirements into the construction documents.
- Develop and implement a commissioning plan.
- Verify the installation and performance of the systems to be commissioned.
- Complete a summary commissioning report.

Commissioned Systems

Commissioning process activities must be completed for the following energy-related systems, at a minimum:

- Heating, ventilating, air conditioning and refrigeration (HVAC&R) systems (mechanical and passive) and associated controls
- Lighting and daylighting controls
- Domestic hot water systems
- Renewable energy systems (e.g., wind, solar)

Potential Technologies & Strategies

Engage a CxA as early as possible in the design process. Determine the owner's project requirements, develop and maintain a commissioning plan for use during design and construction and incorporate commissioning requirements in bid documents. Assemble the commissioning team, and prior to occupancy verify the performance of energy consuming systems. Complete the commissioning reports with recommendations prior to accepting the commissioned systems.

Owners are encouraged to seek out qualified individuals to lead the commissioning process. Qualified individuals are identified as those who possess a high level of experience in the following areas:

- Energy systems design, installation and operation
- Commissioning planning and process management
- Hands-on field experience with energy systems performance, interaction, start-up, balancing, testing, troubleshooting, operation and maintenance procedures
- Energy systems automation control knowledge

Owners are encouraged to consider including water-using systems, building envelope systems, and other systems in the scope of the commissioning plan as appropriate. The building envelope is an important component of a facility that impacts energy consumption, occupant comfort and indoor air quality. While this prerequisite does not require building envelope commissioning, an owner can achieve significant financial savings and reduce risk of poor indoor air quality by including it in the commissioning process.

The LEED 2011 Reference Guide for Green Building Design and Construction, provides guidance on the rigor expected for this prerequisite for the following:

- Owner's project requirements
- Basis of design
- Commissioning plan
- Commissioning specification
- Performance verification documentation
- Commissioning report

EA Prerequisite 2: Minimum Energy Performance

Required

Intent

To establish the minimum level of energy efficiency for the proposed building and systems to reduce environmental and economic impacts associated with excessive energy use.

Requirements

Whole Building Energy Simulation

Demonstrate a 10% improvement in the proposed building performance rating for new buildings, or a 5% improvement in the proposed building performance rating for major renovations to existing buildings, compared with the baseline building performance rating.

Calculate the baseline building performance rating according to the building performance rating method in Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda[1]) using a computer simulation model for the whole building project.

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all energy costs associated with the building project. To achieve points using this credit, the proposed design must meet the following criteria:

- Comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda[17]).
- Include all energy costs associated with the building project.
- Compare against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda[1]). The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps).

Regulated (non-process) energy includes lighting (for the interior, parking garage, surface parking, façade, or building grounds, etc. except as noted above), heating, ventilation and air conditioning (HVAC) (for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes.

Process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and the proposed design, and theoretical or empirical information supporting these assumptions.

[17] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

OR

Demonstrate performance that is equivalent to the above requirements by substituting appropriate benchmarks, protocols and metrics that use a local standard for establishing a baseline, and measure performance relative to that baseline.

NOTE:

The desired comfort temperature range can be taken upto a maximum of 26 ± 2 deg C. In whole building simulation, the same comfort temperature range should be applied for both the base case and design case.

Potential Technologies & Strategies

Design the building envelope and systems to meet baseline requirements. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance compared with a baseline building.

If ECBC (Energy Conservation Building Code of India) or other local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy (DOE) standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ANSI/ASHRAE/IESNA Standard 90.1-2007. Details on the DOE process for commercial energy code determination can be found at http://www.energycodes.gov/implement/determinations_com.stm.

EA Prerequisite 3: Fundamental Refrigerant Management

Required

Intent

To reduce stratospheric ozone depletion.

Requirements

Zero use of chlorofluorocarbon (CFC)-based refrigerants in new base building heating, ventilating, air conditioning and refrigeration (HVAC&R) systems. When reusing existing base building HVAC equipment, complete a comprehensive CFC phase-out conversion prior to project completion. Phase-out plans extending beyond the project completion date will be considered on their merits.

Potential Technologies & Strategies

When reusing existing HVAC systems, conduct an inventory to identify equipment that uses CFC-based refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC-based refrigerants.

EA Credit 1: Optimize Energy Performance

1–19 Points

Intent

To achieve increasing levels of energy performance beyond the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Requirements

Project teams documenting achievement using the below approach are assumed to be in compliance with EA Prerequisite 2: Minimum Energy Performance.

Whole Building Energy Simulation (1–19 points)

Demonstrate a percentage improvement in the proposed building performance rating compared with the baseline building performance rating. Calculate the baseline building performance according to Appendix G of ANSI/ASHRAE/IESNA Standard 90.1-2007 (with errata but without addenda[18]) using a computer simulation model for the whole building project. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15
42%	38%	16
44%	40%	17

[18] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

46%	42%	18
48%	44%	19

Appendix G of Standard 90.1-2007 requires that the energy analysis done for the building performance rating method include all the energy costs associated with the building project. To achieve points under this credit, the proposed design must meet the following criteria:

- Compliance with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2007 (with errata but without addenda).
- Inclusion of all the energy costs within and associated with the building project.
- Comparison against a baseline building that complies with Appendix G of Standard 90.1-2007 (with errata but without addenda). The default process energy cost is 25% of the total energy cost for the baseline building. If the building's process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include documentation substantiating that process energy inputs are appropriate.

For the purpose of this analysis, process energy is considered to include, but is not limited to, office and general miscellaneous equipment, computers, elevators and escalators, kitchen cooking and refrigeration, laundry washing and drying, lighting exempt from the lighting power allowance (e.g., lighting integral to medical equipment) and other (e.g., waterfall pumps).

Regulated (non-process) energy includes lighting (e.g., for the interior, parking garage, surface parking, façade, or building grounds, etc. except as noted above), heating, ventilating, and air conditioning (HVAC) (e.g., for space heating, space cooling, fans, pumps, toilet exhaust, parking garage ventilation, kitchen hood exhaust, etc.), and service water heating for domestic or space heating purposes.

For this credit, process loads must be identical for both the baseline building performance rating and the proposed building performance rating. However, project teams may follow the exceptional calculation method (ANSI/ASHRAE/IESNA Standard 90.1-2007 G2.5) to document measures that reduce process loads. Documentation of process load energy savings must include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

OR

Demonstrate performance that is equivalent to the above requirements by substituting appropriate benchmarks, protocols and metrics that use a local standard for establishing a baseline, and measure performance relative to that baseline.

NOTE:

The desired comfort temperature range can be taken upto a maximum of 26 ± 2 deg C. In whole building simulation, the same comfort temperature range should be applied for both the base case and design case.

Potential Technologies & Strategies

Design the building envelope and systems to maximize energy performance. Use a computer simulation model to assess the energy performance and identify the most cost-effective energy efficiency measures. Quantify energy performance compared with a baseline building.

If ECBC (Energy Conservation Building Code of India) or local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy (DOE) standard process for commercial energy code determination,the results of that analysis may be used to correlate local code performance with ANSI/ASHRAE/IESNA Standard 90.1-2007. Details on the DOE process for commercial energy code determination can be found at http://www.energycodes.gov/implement/determinations_com.stm.

EA Credit 2: On-site Renewable Energy

1–7 Points

Intent

To encourage and recognize increasing levels of on-site renewable energy self-supply to reduce environmental and economic impacts associated with fossil fuel energy use.

Requirements

Use on-site renewable energy systems to offset building energy costs. Calculate project performance by expressing the energy produced by the renewable systems as a percentage of the building's annual energy cost and use the table below to determine the number of points achieved.

The minimum renewable energy percentage for each point threshold is as follows:

Percentage Renewable Energy	Points
1%	1
3%	2
5%	3
7%	4
9%	5
11%	6
13%	7

Potential Technologies & Strategies

Assess the project for nonpolluting and renewable energy potential including solar, wind, geothermal, low-impact hydro, biomass and bio-gas strategies. When applying these strategies, take advantage of net metering with the local utility.

EA Credit 3: Enhanced Commissioning

2 Points

Intent

To begin the commissioning process early in the design process and execute additional activities after systems performance verification is completed.

Requirements

Implement, or have a contract in place to implement, the following additional commissioning process activities in addition to the requirements of EA Prerequisite 1: Fundamental Commissioning of Building Energy Systems and in accordance with the LEED Reference Guide for Green Building Design and Construction:

- Prior to the start of the construction documents phase, designate an independent commissioning authority (CxA) to lead, review and oversee the completion of all commissioning process activities.
- The CxA must have documented commissioning authority experience in at least 2 building projects.
- The individual serving as the CxA:
    - Must be independent of the work of design and construction.
    - Must not be an employee of the design firm, though he or she may be contracted through them.
    - Must not be an employee of, or contracted through, a contractor or construction manager holding construction contracts.
    - May be a qualified employee or consultant of the owner.
- The CxA must report results, findings and recommendations directly to the owner.
- The CxA must conduct, at a minimum, 1 commissioning design review of the owner's project requirements basis of design, and design documents prior to the mid-construction documents phase and back-check the review comments in the subsequent design submission.
- The CxA must review contractor submittals applicable to systems being commissioned for compliance with the owner's project requirements and basis of design. This review must be concurrent with the review of the architect or engineer of record and submitted to the design team and the owner.
- The CxA or other project team members must develop a systems manual that gives future operating staff the information needed to understand and optimally operate the commissioned systems.
- The CxA or other project team members must verify that the requirements for training operating personnel and building occupants have been completed.
- The CxA must be involved in reviewing the operation of the building with operations and maintenance (O&M) staff and occupants within 10 months after substantial completion. A plan for resolving outstanding commissioning-related issues must be included.

Potential Technologies & Strategies

Although it is preferable that the CxA be contracted by the owner, for the enhanced commissioning credit the CxA may also be contracted through the design firms or construction management firms not holding construction contracts.

The LEED Reference Guide for Green Building Design and Construction, provides detailed guidance on the rigor expected for the following process activities:

- Commissioning design review
- Commissioning submittal review
- Systems manual.

EA Credit 4: Enhanced Refrigerant Management

2 Points

Intent

To reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to climate change.

Requirements

OPTION 1

Do not use refrigerants.

OR

OPTION 2

Select refrigerants and heating, ventilation, air conditioning and refrigeration (HVAC&R) equipment that minimize or eliminate the emission of compounds that contribute to ozone depletion and climate change. The base building HVAC&R equipment must comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

Imperial units							
LCGWP	+	LCODP	x	10_5	≤	100	

Metric units						
LCGWP	+	LCODP	x	10^5	≤	13

Calculation definitions for LCGWP + LCODP x 10^5 ≤ 100 (Imperial units)	**Calculation definitions for LCGWP + LCODP x 10^5 ≤ 13 (Metric units)**
LCODP = [ODPr x (Lr x Life +Mr) x Rc]/Life	LCODP = [ODPr x (Lr x Life +Mr) x Rc]/Life
LCGWP = [GWPr x (Lr x Life +Mr) x Rc]/Life	LCGWP = [GWPr x (Lr x Life +Mr) x Rc]/Life
LCODP: Lifecycle Ozone Depletion Potential (lb CFC 11/Ton-Year)	LCODP: Lifecycle Ozone Depletion Potential (kg CFC 11/(kW/year))
LCGWP: Lifecycle Direct Global Warming Potential (lb CO_2/Ton-Year)	LCGWP: Lifecycle Direct Global Warming Potential (kg CO_2/(kW/year))
GWPr: Global Warming Potential of Refrigerant (0 to 12,000 lb CO_2/lbr)	ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 kg CFC 11/kg r)
ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lb CFC 11/lbr)	GWPr: Global Warming Potential of Refrigerant (0 to 12,000 kg CO_2/kg r)

Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)	Lr: Refrigerant Leakage Rate (0.5% to 2.0%; default of 2% unless otherwise demonstrated)
Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)	Mr: End-of-life Refrigerant Loss (2% to 10%; default of 10% unless otherwise demonstrated)
Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of gross ARI rated cooling capacity)	Rc: Refrigerant Charge (0.065 to 0.65 kg of refrigerant per kW of ARI rated or Eurovent Certified cooling capacity)
Life: Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)	Life: Equipment Life (default based on equipment type, unless otherwise demonstrated)

For multiple types of equipment, a weighted average of all base building HVAC&R equipment must be calculated using the following formula:

Imperial units		**Metric units**	
$\frac{\sum (\text{LCGWP} + \text{LCODP} \times 10_5) \times \text{Qunit}}{\text{Qtotal}} \leq 100$		$\frac{\sum (\text{LCGWP} + \text{LCODP} \times 10_5) \times \text{Qunit}}{\text{Qtotal}} \leq 13$	

Calculation definitions for $[\sum (LCGWP + LCODP \times 10^5) \times Qunit] / Qtotal \leq 100$ (Imperial units)	**Calculation definitions for $[\sum (LCGWP + LCODP \times 10^5) \times Qunit] / Qtotal \leq 13$ (Metric units)**
Qunit = Gross ARI rated cooling capacity of an individual HVAC or refrigeration unit (Tons)	Qunit = Eurovent Certified cooling capacity of an individual HVAC or refrigeration unit (kW)
Qtotal = Total gross ARI rated cooling capacity of all HVAC or refrigeration	Qtotal = Total Eurovent Certified cooling capacity of all HVAC or refrigeration (kW)

Small HVAC units (defined as containing less than 0.5 pounds of refrigerant) and other equipment, such as standard refrigerators, small water coolers and any other cooling equipment that contains less than 0.5 pounds of refrigerant, are not considered part of the base building system and are not subject to the requirements of this credit.

Do not operate or install fire suppression systems that contain ozone-depleting substances such as CFCs, hydrochlorofluorocarbons (HCFCs) or halons.

Potential Technologies & Strategies

Design and operate the facility without mechanical cooling and refrigeration equipment. Where mechanical cooling is used, utilize base building HVAC&R systems for the refrigeration cycle that minimize direct impact on ozone depletion and global climate change. Select HVAC&R equipment with reduced refrigerant charge and increased equipment life. Maintain equipment to prevent leakage of refrigerant to the atmosphere. Use fire suppression systems that do not contain HCFCs or halons.

EA Credit 5: Measurement and Verification

3 Points

Intent

To provide for the ongoing accountability of building energy consumption over time.

Requirements

OPTION 1

Develop and implement a measurement and verification (M&V) plan consistent with Option D: Calibrated Simulation (Savings Estimation Method 2) as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003.

The M&V period must cover at least 1 year of post-construction occupancy.

Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

OR

OPTION 2

Develop and implement a measurement and verification (M&V) plan consistent with Option B: Energy Conservation Measure Isolation, as specified in the International Performance Measurement & Verification Protocol (IPMVP) Volume III: Concepts and Options for Determining Energy Savings in New Construction, April 2003.

The M&V period must cover at least 1 year of post-construction occupancy.

Provide a process for corrective action if the results of the M&V plan indicate that energy savings are not being achieved.

Potential Technologies & Strategies

Develop an M&V plan to evaluate building and/or energy system performance. Characterize the building and/or energy systems through energy simulation or engineering analysis. Install the necessary metering equipment to measure energy use. Track performance by comparing predicted performance to actual performance, broken down by component or system as appropriate. Evaluate energy efficiency by comparing actual performance to baseline performance.

While the IPMVP describes specific actions for verifying savings associated with energy conservation measures (ECMs) and strategies, this LEED credit expands upon typical IPMVP M&V objectives. Measurement & verification activities should not necessarily be confined to energy systems where ECMs or energy conservation strategies have been implemented. The IPMVP provides guidance on M&V strategies and their appropriate applications for various situations. These strategies should be used in conjunction with monitoring and trend logging of significant energy systems to provide for the ongoing accountability of building energy performance.

For the corrective action process, consider installing diagnostics within the control system to alert the staff when equipment is not being optimally operated. Conditions that might warrant alarms to alert staff could include:

- Leaking valves in the cooling and heating coils within air handling units;
- Missed economizer opportunities (e.g., faulty economizer damper controls);
- Software and manual overrides allowing equipment to operate 24 hours a day/7 days a week;
- Equipment operation during unusual circumstances (e.g., boiler on when outside air temperature is above 65 °F (18°C)).

Besides control diagnostics, consider employing retro-commissioning services or dedicating staff to investigate increases in energy usage.

EA Credit 6: Green Power

2 Points

Intent

To encourage the development and use of grid-source, renewable energy technologies on a net zero pollution basis.

Requirements

Engage in at least a 2-year renewable energy contract to provide at least 35% of the building's electricity from renewable sources, as defined by the Center for Resource Solutions' Green-e Energy product certification requirements. All purchases of green power shall be based on the quantity of energy consumed, not the cost. Use the annual electricity consumption from the results of EA Credit 1: Optimize Energy Performance, as a basis for the calculations in this credit.

OR

Demonstrate performance that is equivalent to the Green-e Energy National Standard requirements by substituting appropriate benchmarks, protocols and metrics for establishing a baseline, and measure performance relative to that baseline.

NOTE:

In scenarios where several projects by the same developer / owner are contracting to derive 35% of power requirements from the same green power source, the power should be separately accounted for, by separate lease contracts for every single project.

Potential Technologies & Strategies

Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Estimate the energy needs of the building on annual basis. Install green power plants in the country, which meets the 35% of the total energy requirement of the building. Green power is derived from solar, wind, geothermal, biomass, or low-impact hydro sources.

MATERIALS & RESOURCES

MR Prerequisite 1: Storage and Collection of Recyclables

Required

Intent

To facilitate the reduction of waste generated by building occupants that is hauled to and disposed of in landfills.

Requirements

Provide an easily-accessible dedicated area or areas for the collection and storage of materials for recycling for the entire building. Materials must include, at a minimum: paper, corrugated cardboard, glass, plastics and metals.

Potential Technologies & Strategies

Designate an area for recyclable collection and storage that is appropriately sized and located in a convenient area. Identify local waste handlers and buyers for glass, plastic, metals, office paper, newspaper, cardboard and organic wastes. Instruct occupants on recycling procedures. Consider employing cardboard balers, aluminum can crushers, recycling chutes and other waste management strategies to further enhance the recycling program.

MR Credit 1.1: Building Reuse—Maintain Existing Walls, Floors and Roof

1–3 Points

Intent

To extend the lifecycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirements

Maintain the existing building structure (including structural floor and roof decking) and envelope (the exterior skin and framing, excluding window assemblies and non-structural roofing material). The minimum percentage building reuse for each point threshold is as follows:

Building Reuse	Points
55%	1
75%	2
95%	3

Hazardous materials that are remediated as a part of the project must be excluded from the calculation of the percentage maintained. If the project includes an addition that is more than 2 times the floor area of the existing building, this credit is not applicable.

Potential Technologies & Strategies

Consider reusing existing, previously-occupied building structures, envelopes and elements. Remove elements that pose a contamination risk to building occupants and upgrade components that would improve energy and water efficiency such as windows, mechanical systems and plumbing fixtures.

MR Credit 1.2: Building Reuse—Maintain Interior Nonstructural Elements

1 Point

Intent

To extend the lifecycle of existing building stock, conserve resources, retain cultural resources, reduce waste and reduce environmental impacts of new buildings as they relate to materials manufacturing and transport.

Requirements

Use existing interior nonstructural elements (e.g., interior walls, doors, floor coverings and ceiling systems) in at least 50% (by area) of the completed building, including additions. If the project includes an addition with floor area more than 2 times the floor area of the existing building, this credit is not applicable.

Potential Technologies & Strategies

Consider reusing existing building structures, envelopes and interior nonstructural elements. Remove elements that pose a contamination risk to building occupants, and upgrade components that would improve energy and water efficiency such as mechanical systems and plumbing fixtures. Quantify the extent of building reuse.

MR Credit 2: Construction Waste Management

1–2 Points

Intent

To divert construction and demolition debris from disposal in landfills and incineration facilities. Redirect recyclable recovered resources back to the manufacturing process and reusable materials to appropriate sites.

Requirements

Recycle and/or salvage nonhazardous construction and demolition debris. Develop and implement a construction waste management plan that, at a minimum, identifies the materials to be diverted from disposal and whether the materials will be sorted on-site or comingled. Excavated soil and land-clearing debris do not contribute to this credit. Calculations can be done by weight or volume, but must be consistent throughout. The minimum percentage debris to be recycled or salvaged for each point threshold is as follows:

Recycled or Salvaged	Points
50%	1
75%	2

Potential Technologies & Strategies

Establish goals for diversion from disposal in landfills and incineration facilities and adopt a construction waste management plan to achieve these goals. Consider recycling cardboard, metal, brick, mineral fiber panel, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. Construction debris processed into a recycled content commodity that has an open market value (e.g., wood derived fuel [WDF], alternative daily cover material, etc.) may be applied to the construction waste calculation. Designate a specific area(s) on the construction site for segregated or comingled collection of recyclable materials, and track recycling efforts throughout the construction process. Identify construction haulers and recyclers to handle the designated materials. Note that diversion may include donation of materials to charitable organizations and salvage of materials on-site.

MR Credit 3: Materials Reuse

1–2 Points

Intent

To reuse building materials and products to reduce demand for virgin materials and reduce waste, thereby lessening impacts associated with the extraction and processing of virgin resources.

Requirements

Use salvaged, refurbished or reused materials, the sum of which constitutes at least 5% or 10%, based on cost, of the total value of materials on the project. The minimum percentage materials reused for each point threshold is as follows:

Reused Materials	Points
5%	1
10%	2

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

Potential Technologies & Strategies

Identify opportunities to incorporate salvaged materials into the building design, and research potential material suppliers. Consider salvaged materials such as beams and posts, flooring, paneling, doors and frames, cabinetry and furniture, brick, and decorative items.

MR Credit 4: Recycled Content

1–2 Points

Intent

To increase demand for building products that incorporate recycled content materials, thereby reducing impacts resulting from extraction and processing of virgin materials.

Requirements

Use materials with recycled content[19] such that the sum of postconsumer[20] recycled content plus 1/2 of the preconsumer[21] content constitutes at least 10% or 20%, based on cost, of the total value of the materials in the project. The minimum percentage materials recycled for each point threshold is as follows:

Recycled Content	Points
10%	1
20%	2

The recycled content value of a material assembly is determined by weight. The recycled fraction of the assembly is then multiplied by the cost of assembly to determine the recycled content value.

Mechanical, electrical and plumbing components and specialty items such as elevators cannot be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

Potential Technologies & Strategies

Establish a project goal for recycled content materials, and identify material suppliers that can achieve this goal. During construction, ensure that the specified recycled content materials are installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

[19] Recycled content is defined in accordance with the International Organization of Standards document, ISO 14021 — Environmental labels and declarations — Self-declared environmental claims (Type II environmental labeling).

[20] Postconsumer material is defined as waste material generated by households or by commercial, industrial and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose.

[21] Preconsumer material is defined as material diverted from the waste stream during the manufacturing process. Reutilization of materials (i.e., rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it) is excluded.

MR Credit 5: Regional Materials

1–2 Points

Intent

To increase demand for building materials and products that are extracted and manufactured within the region, thereby supporting the use of indigenous resources and reducing the environmental impacts resulting from transportation.

Requirements

Use building materials or products that have been extracted, harvested or recovered, as well as manufactured, within 250 miles (400 kilometers) of the project site for a minimum of 10% or 20%, based on cost, of the total materials value. If only a fraction of a product or material is extracted, harvested, or recovered and manufactured locally, then only that percentage (by weight) can contribute to the regional value. The minimum percentage regional materials for each point threshold is as follows:

Regional Materials	Points
10%	1
20%	2

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment must not be included in this calculation. Include only materials permanently installed in the project. Furniture may be included if it is included consistently in MR Credit 3: Materials Reuse through MR Credit 7: Certified Wood.

Potential Technologies & Strategies

Establish a project goal for locally sourced materials, and identify materials and material suppliers that can achieve this goal. During construction, ensure that the specified local materials are installed, and quantify the total percentage of local materials installed. Consider a range of environmental, economic and performance attributes when selecting products and materials.

MR Credit 6: Rapidly Renewable Materials

1 Point

Intent

To reduce the use and depletion of finite raw materials and long-cycle renewable materials by replacing them with rapidly renewable materials.

Requirements

Use rapidly renewable building materials and products for 2.5% of the total value of all building materials and products used in the project, based on cost. Rapidly renewable building materials and products are made from plants that are typically harvested within a 10-year or shorter cycle.

Potential Technologies & Strategies

Establish a project goal for rapidly renewable materials, and identify products and suppliers that can support achievement of this goal. Consider materials such as bamboo, wool, cotton insulation, agrifiber, linoleum, wheatboard, strawboard and cork. During construction, ensure that the specified renewable materials are installed.

MR Credit 7: Certified Wood

1 Point

Intent

To encourage environmentally responsible forest management.

Requirements

Use a minimum of 50% (based on cost) of wood-based materials and products that are certified in accordance with the Forest Stewardship Council's principles and criteria, for wood building components. These components include at a minimum, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

Include only materials permanently installed in the project. Wood products purchased for temporary use on the project (e.g., formwork, bracing, scaffolding, sidewalk protection, and guard rails) may be included in the calculation at the project team's discretion. If any such materials are included, all such materials must be included in the calculation. If such materials are purchased for use on multiple projects, the applicant may include these materials for only one project, at its discretion. Furniture may be included if it is included consistently in MR Credits 3, Materials Reuse, through MR Credit 7, Certified Wood.

Potential Technologies & Strategies

Establish a project goal for FSC-certified wood products and identify suppliers that can achieve this goal. During construction, ensure that the FSC-certified wood products are installed and quantify the total percentage of FSC-certified wood products installed.

INDOOR ENVIRONMENTAL QUALITY

IEQ Prerequisite 1: Minimum Indoor Air Quality Performance

Required

Intent

To establish minimum indoor air quality (IAQ) performance to enhance indoor air quality in buildings, thus contributing to the comfort and well-being of the occupants.

Requirements

Meet the minimum requirements of Sections 4 through 7 of ASHRAE Standard 62.1-2007, Ventilation for Acceptable Indoor Air Quality (with errata but without addenda[22]).

OR

Use a Local standard for establishing a baseline and measure performance relative to that baseline, to demonstrate equivalency with the above requirements of ASHRAE. The following general topics must be addressed in establishing acceptable benchmarks and metrics used for demonstrating equivalency with ASHRAE Standard 62.1–2007, Sections 4 through 7 (with errata but without addenda) :

- Outdoor air quality
- Systems and equipment
- Ventilation rate procedure and indoor air quality (IAQ) procedure
- Construction and system start-up

AND

CASE 1. Mechanically Ventilated Spaces

Mechanical ventilation systems must be designed using the ASHRAE 62.1 ventilation rate procedure **(OR)** the applicable local code, whichever is more stringent.

CASE 2. Naturally Ventilated Spaces

Use a local standard for establishing a baseline and measure performance relative to that baseline, to demonstrate equivalency with the requirements of ASHRAE Standard 62.1–2007, Paragraph 5.1 (with errata but without addenda[1]). The following general topics must be addressed in establishing acceptable benchmarks and metrics for demonstrating equivalency with the ASHRAE standard.

- Naturally ventilated spaces must be permanently open to the outdoors and within 25 feet (8 meters) of operable wall or roof openings.
- The openable area must be at least 4% of the net occupiable floor area. If an opening is covered with louvers or otherwise partially obstructed, calculate the openable area based on the free, unobstructed area.
- If an interior space without direct openings to the outdoors is ventilated through an adjoining room, the opening between the rooms must be permanently unobstructed and be at least 8% of the area of the interior room or 25 square feet (2 square meters).
- Whenever the space is occupied, building occupants must have a readily accessible way to control the opening.

[22] Project teams wishing to use ASHRAE approved addenda for the purposes of this prerequisite may do so at their discretion. Addenda must be applied consistently across all LEED credits.

If approved by the local authority, an engineered natural ventilation system need not meet the above requirements for location and size of openings and accessible controls.

Potential Technologies & Strategies

Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard or the equivalent benchmark based on Local standard. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant comfort. Use the ASHRAE Standard 62.1-2007 Users Manual (with errata but without addenda) or relevant sections of the equivalent local standard for detailed guidance on meeting the referenced requirements.

IEQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control

Required

Intent

To prevent or minimize exposure of building occupants, indoor surfaces and ventilation air distribution systems to environmental tobacco smoke (ETS).

Requirements

OPTION 1

Prohibit smoking in the building.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

OR

OPTION 2

CASE 1. Non-Residential Projects

Prohibit smoking in the building except in designated smoking areas.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

Provide designated smoking rooms designed to contain, capture and remove ETS from the building. At a minimum, the smoking room must be directly exhausted to the outdoors, away from air intakes and building entry paths, with no recirculation of ETS-containing air to nonsmoking areas and enclosed with impermeable deck-to-deck partitions. The smoking room must be operated at a negative pressure, compared with the surrounding spaces, of at least an average of 5 Pascals (Pa) (0.02 inches of water gauge) and a minimum of 1 Pa (0.004 inches of water gauge) when the doors to the smoking rooms are closed.

Verify performance of the smoking rooms' differential air pressures by conducting 15 minutes of measurement, with a minimum of 1 measurement every 10 seconds, of the differential pressure in the smoking room with respect to each adjacent area and in each adjacent vertical chase with the doors to the smoking room closed. Conduct the testing with each space configured for worst-case conditions of transport of air from the smoking rooms (with closed doors) to adjacent spaces.

CASE 2. Residential and Hospitality Projects

Prohibit smoking in all common areas of the building.

Locate any exterior designated smoking areas, including balconies where smoking is permitted, at least 25 feet (8 meters) from entries, outdoor air intakes and operable windows opening to common areas.

Prohibit on-property smoking within 25 feet (8 meters) of entries, outdoor air intakes and operable windows. Provide signage to allow smoking in designated areas, prohibit smoking in designated areas or prohibit smoking on the entire property.

Weather-strip all exterior doors and operable windows in the residential units to minimize leakage from outdoors.

Minimize uncontrolled pathways for ETS transfer between individual residential units by sealing penetrations in walls, ceilings and floors in the residential units and by sealing vertical chases adjacent to the units.

Weather-strip all doors in the residential units leading to common hallways to minimize air leakage into the hallway[23].

Potential Technologies & Strategies

Prohibit smoking in commercial buildings or effectively control the ventilation air in smoking rooms. For residential buildings, prohibit smoking in common areas and design building envelope and systems to minimize ETS transfer among dwelling units.

[23] If the common hallways are pressurized with respect to the residential units then doors in the residential units leading to the common hallways need not be weather-stripped provided that the positive differential pressure is demonstrated as in Option 2, Case 1 above, considering the residential unit as the smoking room.

IEQ Credit 1: Outdoor Air Delivery Monitoring

1 Point

Intent

To provide capacity for ventilation system monitoring to help promote occupant comfort and well-being.

Requirements

Install permanent monitoring systems to ensure that ventilation systems maintain design minimum requirements. Configure all monitoring equipment to generate an alarm when airflow values or carbon dioxide (CO2) levels vary by 10% or more from the design values via either a building automation system alarm to the building operator or a visual or audible alert to the building occupants.

AND

CASE 1. Mechanically Ventilated Spaces

Monitor CO2 concentrations within all densely occupied spaces i.e., those with a design occupant density of 25 people or more per 1,000 square feet (95 square meters). CO2 monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor.[24]

Provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor air intake flow with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2007 (with errata but without addenda[25]) for mechanical ventilation systems **(OR)** an equivalent local standard, where 20% or more of the design supply airflow serves nondensely occupied spaces.

If using a local standard for establishing a baseline and measuring performance relative to that baseline, the following general topics must be addressed for equivalency with ASHRAE Standard 62.1–2007 (with errata but without addenda):

- Ventilation rate procedure
- Indoor air quality (IAQ) procedure
- Design documentation procedures

CASE 2. Naturally Ventilated Spaces

Monitor CO2 concentrations within all naturally ventilated spaces. CO2 monitors must be between 3 and 6 feet (between 1 and 2 meters) above the floor. One CO2 sensor may be used to monitor multiple nondensely occupied spaces if the natural ventilation design uses passive stack(s) or other means to induce airflow through those spaces equally and simultaneously without intervention by building occupants.

Potential Technologies & Strategies

Install CO2 and airflow measurement equipment and feed the information to the heating, ventilating and air conditioning (HVAC) system and/or building automation system (BAS) to trigger corrective action, if applicable. If such automatic controls are not feasible with the building systems, use the measurement equipment to trigger alarms that inform building operators or occupants of a possible deficiency in outdoor air delivery.

---

[24] CO2 monitoring is required in densely occupied spaces, in addition to outdoor air intake flow measurement.

[25] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

IEQ Credit 2: Increased Ventilation

1 Point

Intent

To provide additional outdoor air ventilation to improve indoor air quality (IAQ) and promote occupant comfort, well-being and productivity.

Requirements

CASE 1. Mechanically Ventilated Spaces

Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2007 (with errata but without addenda[26]) **(OR)** an equivalent Local standard, as determined by IEQ Prerequisite 1: Minimum Indoor Air Quality Performance.

If using a local standard for establishing a baseline and measuring performance relative to that baseline, the following general topics must be addressed for equivalency with ASHRAE Standard 62.1–2007 (with errata but without addenda):

- Outdoor air quality
- Systems and equipment
- Ventilation rate procedure and indoor air quality IAQ (indoor air quality) procedure
- Construction and system start-up

For more details, see the ASHRAE Reference Guide or relevant sections of the equivalent Local standard.

CASE 2. Naturally Ventilated Spaces

Determine that natural ventilation is an effective strategy for the project by following the requirements of the flow diagram process shown in the CIBSE Applications Manual 10: 2005, Figure 2.8.

OR

Use a Local standard to demonstrate performance that is equivalent to CIBSE by establishing a baseline, and measure performance relative to that baseline. The following guidelines outline the methodology for establishing acceptable benchmarks and metrics to demonstrate equivalency of the Local standard with Figure 2.8 of CIBSE AM 10:2005:

- Heat gain
- Transient occupancy
- Seasonal mixed-mode ventilation
- Floor plan
- Courtyard or atrium layout
- Zonal mixed-mode ventilation
- Perimeter zone conditions, including noise and pollution levels
- Control of ventilation by occupants
- Temperature and relative humidity control
- Humidification

[26] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

AND

OPTION 1

Show that the natural ventilation systems design meets the recommendations set forth in the CIBSE manuals appropriate to the project space. **(OR)** Use a local standard to demonstrate performance that is equivalent to the requirements of CIBSE Applications Manual 10: 2005 or CIBSE AM 13: 2000, Mixed Mode Ventilation, by substituting appropriate benchmarks and metrics for establishing a baseline, and measure performance relative to that baseline.

PATH 1:

Use CIBSE Applications Manual 10: 2005, Natural Ventilation in Non-domestic Buildings (OR) use a local standard to address the following general topics and demonstrate equivalency with CIBSE AM 10: 2005:

Design Strategy

- Design
- Selection process for natural ventilation
- Wind and stack effects
- Natural ventilation strategies (e.g., chimney ventilation, stack ventilation)

Ventilation Components and System Integration

- Principles, products and processes for ventilation and control
- Ventilation opening types
- Internal obstructions
- Background leakage
- Window stays and automatic actuators
- Control system
- Installation and commissioning

Design Calculations

- Required flow rates
- Ventilation design tool selection
- Design procedures using envelope flow models
- Input data requirements and selection
- Reservoir effect

PATH 2.

Use CIBSE AM 13:2000, Mixed Mode Ventilation (OR) use a local standard to address the following general topics and demonstrate equivalency with CIBSE AM 13: 2000:

- Mixed mode ventilation types
- Design principles for mixed mode buildings and systems
- Building fabric properties
- Contingency mixed mode
- Complementary mixed mode

- Zoned mixed-mode systems
- Control of mixed-mode systems
- Commissioning considerations for the designer
- Handover, management and operation considerations for the designer
- Modeling and modeling techniques
- Energy and environmental benefits
- Window design
- Thermal comfort
- Commissioning activities
- Handover, management, operation and maintenance considerations

OR

OPTION 2

Use a macroscopic, multizone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2007 Chapter 6 (with errata but without addenda[1]), for at least 90% of occupied spaces. **(OR)** Use a Local standard to demonstrate minimum ventilation rate performance equivalent to the requirements of ASHRAE 62.1–2007, Chapter 6 (with errata but without addenda[1]), for at least 90% of occupied spaces, by substituting appropriate benchmarks and metrics for establishing a baseline, and measure performance relative to that baseline. The following general topics must be addressed to demonstrate equivalency with ASHRAE:

- Ventilation rate procedure
- Indoor air quality (IAQ) procedure
- Design documentation procedures

Potential Technologies & Strategies

For mechanically ventilated spaces: Use heat recovery, where appropriate, to minimize the additional energy consumption associated with higher ventilation rates.

For naturally ventilated spaces, follow the 8 design steps described in the Carbon Trust Good Practice Guide 237:

- Develop design requirements.
- Plan airflow paths.
- Identify building uses and features that might require special attention.
- Determine ventilation requirements.
- Estimate external driving pressures.
- Select types of ventilation devices.
- Size ventilation devices.
- Analyze the design.

Use public domain software such as NIST's CONTAM, Multizone Modeling Software, along with LoopDA, Natural Ventilation Sizing Tool, to analytically predict room-by-room airflows.

IEQ Credit 3.1: Construction Indoor Air Quality Management Plan- During Construction

1 Point

Intent

To reduce indoor air quality (IAQ) problems resulting from construction or renovation and promote the comfort and well-being of construction workers and building occupants.

Requirements

Develop and implement an IAQ management plan for the construction and preoccupancy phases of the building as follows:

- During construction, meet or exceed the recommended control measures of the Sheet Metal and Air Conditioning National Contractors Association (SMACNA) IAQ Guidelines For Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).
- Protect stored on-site and installed absorptive materials from moisture damage.
- If permanently installed air handlers are used during construction, filtration media with a minimum efficiency reporting value (MERV) of 8 must be used at each return air grille, as determined by ASHRAE Standard 52.2-1999 (with errata but without addenda[27]). Replace all filtration media immediately prior to occupancy.

OR

Develop and implement an IAQ management plan for the construction and preoccupancy phases of the building as follows:

- During construction, address the following project-specific issues:

HVAC Protection

a. Avoid using permanently installed HVAC systems if possible. Use temporary systems where possible.

b. If permanently installed air handlers are used during construction, filtration media must be used at each return air grille. Filtration must have a minimum efficiency of 30% or an arrestance of greater than 90%. Replace all filtration media immediately prior to occupancy.

c. Store equipment in a clean, dry location. Protect ducts and equipment by sealing openings with plastic.

d. Clean air plenums before use.

Source Control

a. Avoid finish materials with high VOC and formaldehyde levels.

b. Recover, isolate and ventilate as appropriate when using any toxic materials or creating exhaust fumes.

c. Protect stored on-site and installed absorptive materials from moisture damage. Do not install moisture-damaged materials unless they have been properly dried.

d. Implement measures to avoid the tracking of pollutants into work area and occupied portions of the building.

[27] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

Pathway Interruption

a. Isolate areas to prevent contamination of clean or occupied spaces using physical separation and depressurization.

Housekeeping

a. Implement practices to ensure a clean job site to control potential contaminants such as dirt, dust and debris.

b. Clean up spills, and keep work areas dry.

c. Scheduling

d. Coordinate construction activities to minimize disruption of occupied spaces.

e. Carefully sequence construction activities to minimize IAQ issues.

- Protect stored on-site and installed absorptive materials from moisture damage.

- If permanently installed air handlers are used during construction, one of the following filtration media must be used at each return air grille. Replace all filtration media immediately prior to occupancy.

    a. Filtration media with a minimum efficiency reporting value (MERV) of 8 or higher, as determined by ASHRAE Standard 52.2–1999 (with errata but without addenda).

    b. Equivalent filtration media Class F5 or higher, as defined by CEN Standard EN 779-2002, Particulate air filters for general ventilation, Determination of the filtration performance.

    c. Equivalent filtration media with a minimum duct spot efficiency of 30% or higher and greater than 90% arrestance on a particle size of 3–10 µg.

Potential Technologies & Strategies

Adopt an IAQ management plan to protect the heating, ventilating and air conditioning (HVAC) system during construction, control pollutant sources and interrupt contamination pathways. Sequence the installation of materials to avoid contamination of absorptive materials, such as insulation, carpeting, ceiling tile and gypsum wallboard. Coordinate with IEQ Credit 3.2: Construction IAQ Management Plan — Before Occupancy and IEQ Credit 5: Indoor Chemical & Pollutant Source Control to determine the appropriate specifications and schedules for filtration media.

If possible, avoid using permanently installed air handlers for temporary heating/cooling during construction. Consult the LEED 2011 for India Reference Guide, for more detailed information on how to ensure the well-being of construction workers and building occupants if permanently installed air handlers must be used during construction.

IEQ Credit 3.2: Construction Indoor Air Quality Management Plan- Before Occupancy

1 Point

Intent

To reduce indoor air quality (IAQ) problems resulting from construction or renovation to promote the comfort and well-being of construction workers and building occupants.

Requirements

Develop an IAQ management plan and implement it after all finishes have been installed and the building has been completely cleaned before occupancy.

OPTION 1. Flush-Out[28]

PATH 1

After construction ends, prior to occupancy and with all interior finishes installed, install new filtration media and, perform a building flush-out by supplying a total air volume of 14,000 cubic feet of outdoor air per square foot (4,500 cubic meters of outdoor air per square meter) of floor area while maintaining an internal temperature of at least 60° F (15°C) and relative humidity no higher than 60%.

OR

PATH 2

If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cubic feet of outdoor air per square foot (1,000 cubic meters of outdoor air per square meter) of floor area. Once the space is occupied, it must be ventilated at a minimum rate of 0.30 cubic feet per minute (cfm) per square foot (0.1 cubic meters of outside air per minute per square meter) of outside air or the design minimum outside air rate determined in IEQ Prerequisite 1: Minimum Indoor Air Quality Performance, whichever is greater. During each day of the flush-out period, ventilation must begin a minimum of 3 hours prior to occupancy and continue during occupancy. These conditions must be maintained until a total of 14,000 cubic feet per square foot (4,500 cubic meters of outside air per square meter) of outside air has been delivered to the space.

OR

OPTION 2. Air Testing

Conduct baseline IAQ testing after construction ends and prior to occupancy using testing protocols consistent with the EPA Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the LEED Reference Guide for Green Building Design and Construction. (**OR)** Use a local standard to get testing protocols consistent with the above EPA standard by substituting appropriate benchmarks and metrics for establishing a baseline, and measuring performance relative to that baseline.

The following guidelines outline the methodology for establishing acceptable benchmarks and metrics pertaining to this credit's requirements by using an equivalent local standard.

[28] All finishes must be installed prior to flush-out.

Demonstrate that the contaminant maximum concentration levels listed below are not exceeded:

Contaminant	Maximum Concentration
Formaldehyde	27 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total volatile organic compounds (TVOCs)	500 micrograms per cubic meter
4-Phenylcyclohexene (4-PCH)*	6.5 micrograms per cubic meter
Carbon monoxide (CO)	9 part per million and no greater than 2 parts per million above outdoor levels
* This test is only required if carpets and fabrics with styrene butadiene rubber (SBR) latex backing are installed as part of the base building systems.	

For each sampling point where the maximum concentration limits are exceeded, conduct an additional flush-out with outside air and retest the noncompliant concentrations. Repeat until all requirements are met. When retesting noncompliant building areas, take samples from the same locations as in the first test, although it is not required.

Conduct the air sample testing as follows:

- All measurements must be conducted prior to occupancy, but during normal occupied hours with the building ventilation system started at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the test.

- All interior finishes must be installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Movable furnishings such as workstations and partitions should be in place for the testing, although it is not required.

- The number of sampling locations will depend on the size of the building and number of ventilation systems. For each portion of the building served by a separate ventilation system, the number of sampling points must not be less than 1 per 25,000 square feet (1 per 2,300 square meters) or for each contiguous floor area, whichever is larger. Include areas with the least ventilation and greatest presumed source strength.

- Air samples must be collected between 3 and 6 feet (between 1 and 2 meters) from the floor to represent the breathing zone of occupants, and over a minimum 4-hour period.

Potential Technologies & Strategies

Prior to occupancy, perform a building flush-out or test the air contaminant levels in the building. The flush-out is often used where occupancy is not required immediately upon substantial completion of construction. IAQ testing can minimize schedule impacts but may be more costly. Coordinate with IEQ Credit 3.1: Construction IAQ Management Plan — During Construction and IEQ Credit 5: Indoor Chemical & Pollutant Source Control to determine the appropriate specifications and schedules for filtration media.

The intent of this credit is to eliminate IAQ problems that occur as a result of construction. Architectural finishes used in tenant build-outs constitute a significant source of air pollutants and must be addressed to qualify for this credit.

IEQ Credit 4.1: Low-Emitting Materials—Adhesives and Sealants

1 Point

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

All adhesives and sealants used on the interior of the building (i.e., inside the weatherproofing system and applied on-site) must comply with the following requirements as applicable to the project scope :

Adhesives, sealants and sealant primers must comply with the VOC limits listed in the table below. These limits are from the ICC Evaluation Service (ICC-ES) EG105 Evaluation Guideline for Determination of Volatile Organic Compound (VOC) Content and Emissions of Adhesives and Sealants (http://www.saveprogram.icc-es.org/guidelines/).

Architectural Applications	VOC Limit (g/L less water)	Specialty Applications	VOC Limit (g/L less water)
Indoor carpet adhesives	50	PVC welding	510
Carpet pad adhesives	50	CPVC welding	490
Wood flooring adhesives	100	ABS welding	325
Rubber floor adhesives	60	Plastic cement welding	250
Subfloor adhesives	50	Adhesive primer for plastic	550
Ceramic tile adhesives	65	Contact adhesive	80
VCT and asphalt adhesives	50	Special purpose contact adhesive	250
Drywall and panel adhesives	50	Structural wood member adhesive	140
Cove base adhesives	50	Sheet applied rubber lining operations	850
Multipurpose construction adhesives	70	Top and trim adhesive	250
Structural glazing adhesives	100		

Substrate Specific Applications	VOC Limit (g/L less water)	Sealants	VOC Limit (g/L less water)
Metal to metal	30	Architectural	250
Plastic foams	50	Nonmembrane roof	300
Porous material (except wood)	50	Roadway	250
Wood	30	Single-ply roof membrane	450
Fiberglass	80	Other	420
Sealant Primers	**VOC Limit (g/L less water)**		
Architectural, nonporous	250		
Architectural, porous	775		
Other	750		

- Aerosol adhesives must comply with the VOC limits listed in the table below. These limits are from the ICC Evaluation Service (ICC-ES) EG105 Evaluation Guideline for Determination of Volatile Organic Compound (VOC) Content and Emissions of Adhesives and Sealants (http://www.saveprogram.icc-es.org/guidelines/).

Aerosol Adhesives	VOC Limit
General purpose mist spray	65% VOCs by weight
General purpose web spray	55% VOCs by weight
Special purpose aerosol adhesives (all types)	70% VOCs by weight

Potential Technologies & Strategies

Specify low-VOC materials in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where adhesives and sealants are addressed. Common products to evaluate include general construction adhesives, flooring adhesives, fire-stopping sealants, caulking, duct sealants, plumbing adhesives and cove base adhesives. Review product cut sheets, material safety data (MSD) sheets, signed attestations or other official literature from the manufacturer clearly identifying the VOC contents or compliance with referenced standards.

IEQ Credit 4.2: Low-Emitting Materials—Paints and Coatings

1 Point

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

Paints and coatings used on the interior of the building (i.e., inside the weatherproofing system and applied on-site) must comply with the following criteria as applicable to the project scope[1]:

- Architectural paints and coatings applied to interior walls and ceilings must not exceed the volatile organic compound (VOC) limits listed in Tables 1 and 2 in the Reference Guide.

- Anti-corrosive and anti-rust paints applied to interior ferrous metal substrates must not exceed the VOC content limits below:

Anti-Corrosive and Anti-Rust Paints Coating Type	VOC Limit g/L (lb/gal) Minus Water
Gloss	250g/L (2 lb/gal)
Semi-Gloss	250g/L (2 lb/gal)
Flat	250g/L (2 lb/gal)

- Clear wood finishes, floor coatings, stains, primers and shellacs applied to interior elements must not exceed the VOC limits listed in Tables 1 and 2 in the Reference Guide.

Potential Technologies & Strategies

Specify low-VOC paints and coatings in construction documents. Ensure that VOC limits are clearly stated in each section of the specifications where paints and coatings are addressed. Track the VOC content of all interior paints and coatings during construction.

IEQ Credit 4.3: Low-Emitting Materials—Flooring Systems

1 Point

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

All flooring must comply with the following as applicable to the project scope:

- All carpet installed in the building interior must demonstrate equivalence to the emissions test criteria of the CRI Green Label Plus Carpet Program (http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/carpet-and-adhesive.cfm or http://www.carpet-rug.org/pdf_word_docs/071028_Carpet_GLP_Criteria.pdf) using the ICC Evaluation Service (ICC-ES) Evaluation Guideline for Determination of Volatile Organic Compound (VOC) Content and Emissions of Floor Covering Products, EG107, as a testing protocol (http://www.saveprogram.icc-es.org/guidelines/pdf/EG107.pdf). For more information, see the Reference Guide, Figure 1, Sample Product Information for CRI Green Label Plus Carpeting.

- All carpet cushion installed in the building interior must demonstrate maximum emissions factors less than stated below (from http://www.carpet-rug.org/commercial-customers/green-building-and-the-environment/green-label-plus/cushion.cfm). The testing protocol must follow the ICC Evaluation Service (ICC-ES) Evaluation Guideline for Determination of Volatile Organic Compound (VOC) Content and Emissions of Floor Covering Products, EG107 (http://www.saveprogram.icc-es.org/guidelines/pdf/EG107.pdf).

	Maximum Allowance
TVOCs	1000 µg/m² per hour
BHT	300 µg/m² per hour
Formaldehyde	50 µg/m² per hour
4-PCH	50 µg/m² per hour

- All carpet adhesive must meet the requirements of IEQ Credit 4.1: Adhesives and Sealants, which includes a volatile organic compound (VOC) limit of 50 g/L (0.4 lb/gal).

- All hard surface flooring must demonstrate maximum emissions factors less than or equal to those stated below, as shown with testing by an independent third party. Mineral-based finish flooring products such as tile, masonry, terrazzo, and cut stone without integral organic-based coatings and sealants and unfinished/untreated solid wood flooring qualify for credit without any IAQ testing requirements. However, associated site-applied adhesives, grouts, finishes and sealers must be compliant for a mineral-based or unfinished/untreated solid wood flooring system to qualify for credit. The testing protocol to determine the emissions factors must follow the ICC Evaluation Service (ICC-ES) Evaluation Guideline for Determination of Volatile Organic Compound (VOC) Content and Emissions of Floor Covering Products, EG107 (http://www.saveprogram.icc-es.org/guidelines/pdf/EG107.pdf).

a. Formaldehyde, 1.65 µg/m^3 per hour

b. Acetaldehyde, 9 µg/m^3 per hour

c. All other organic chemicals with established Chronic Reference Exposure Levels (CRELs) less than or equal to 1/2 CREL as listed in the latest edition of the Cal/EPA OEHHA list of chemicals with noncancer CRELs (http://www.oehha.ca.gov/air/chronic_rels/AllChrels.html).

- Concrete, wood, bamboo and cork floor finishes such as sealer, stain and finish must not exceed the VOC limits listed in IEQ Credit 4.2: Paints and Coatings.
- Tile setting adhesives and grout must not exceed the VOC limits listed in IEQ Credit 4.1: Adhesives and Sealants.

Potential Technologies & Strategies

Clearly specify requirements for product testing and/or certification in the construction documents. Select products that are either certified under the Green Label Plus program or for which testing has been done by qualified independent laboratories in accordance with the appropriate requirements.

IEQ Credit 4.4: Low-Emitting Materials—Composite Wood and Agrifiber Products

1 Point

Intent

To reduce the quantity of indoor air contaminants that are odorous, irritating and/or harmful to the comfort and well-being of installers and occupants.

Requirements

Composite wood and agrifiber products used on the interior of the building (i.e., inside the weatherproofing system) must contain no added urea-formaldehyde resins. Laminating adhesives used to fabricate on-site and shop-applied composite wood and agrifiber assemblies must not contain added urea-formaldehyde resins.

Composite wood and agrifiber products are defined as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates and door cores. Materials considered fixtures, furniture and equipment (FF&E) are not considered base building elements and are not included.

Potential Technologies & Strategies

Specify wood and agrifiber products that contain no added urea-formaldehyde resins. Specify laminating adhesives for field and shop-applied assemblies that contain no added urea-formaldehyde resins. Review product cut sheets, material safety data (MSD) sheets, signed attestations or other official literature from the manufacturer.

IEQ Credit 5: Indoor Chemical and Pollutant Source Control

1 Point

Intent

To minimize building occupant exposure to potentially hazardous particulates and chemical pollutants.

Requirements

Design to minimize and control the entry of pollutants into buildings and later cross-contamination of regularly occupied areas through the following strategies:

- Employ permanent entryway systems at least 10 feet (3 meters) long in the primary direction of travel to capture dirt and particulates entering the building at regularly used exterior entrances. Acceptable entryway systems include permanently installed grates, grill s and slotted systems that allow for cleaning underneath. Roll-out mats are acceptable only when maintained on a weekly basis by a contracted service organization.

- Sufficiently exhaust each space where hazardous gases or chemicals may be present or used (e.g., garages, housekeeping and laundry areas, copying and printing rooms) to create negative pressure with respect to adjacent spaces when the doors to the room are closed. For each of these spaces, provide self-closing doors and deck-to-deck partitions or a hard-lid ceiling. The exhaust rate must be at least 0.50 cubic feet per minute (cfm) per square foot (0.15 cubic meters per minute per square meter) with no air recirculation. The pressure differential with the surrounding spaces must be at least 5 Pascals (Pa) (0.02 inches of water gauge) on average and 1 Pa (0.004 inches of water) at a minimum when the doors to the rooms are closed.

- Provide containment (i.e. a closed container for storage for off-site disposal in a regulatory compliant storage area, preferably outside the building) for appropriate disposal of hazardous liquid wastes in places where water and chemical concentrate mixing occurs (e.g., housekeeping, janitorial and science laboratories).

- In mechanically ventilated buildings, install new air filtration media in regularly occupied areas prior to occupancy; these filters must provide a minimum efficiency reporting value (MERV) of 13 or higher. Filtration should be applied to process both return and outside air that is delivered as supply air. (OR) Equivalent filtration media with a minimum duct spot efficiency of 80% or higher and greater than 98% arrestance on a particle size of 3–10 μg.

Potential Technologies & Strategies

Design facility cleaning and maintenance areas with isolated exhaust systems for contaminants. Maintain physical isolation from the rest of the regularly occupied areas of the building. Install permanent architectural entryway systems such as grills or grates to prevent occupant-borne contaminants from entering the building. Install high-level filtration systems in air handling units processing outside supply air. Ensure that air handling units can accommodate required filter sizes and pressure drops.

IEQ Credit 6.1: Controllability of Systems—Lighting

1 Point

Intent

To provide a high level of lighting system control by individual occupants or groups in multi-occupant spaces (e.g., classrooms and conference areas) and promote their productivity, comfort and well-being.

Requirements

Provide individual lighting controls for 90% (minimum) of the building occupants to enable adjustments to suit individual task needs and preferences

Provide lighting system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Potential Technologies & Strategies

Design the building with occupant controls for lighting. Strategies to consider include lighting controls and task lighting. Integrate lighting systems controllability into the overall lighting design, providing ambient and task lighting while managing the overall energy use of the building.

IEQ Credit 6.2: Controllability of Systems—Thermal Comfort

1 Point

Intent

To provide a high level of thermal comfort system control[29] by individual occupants or groups in multi-occupant spaces (e.g., classrooms or conference areas) and promote their productivity, comfort and well-being.

Requirements

- Provide individual comfort controls for 50% (minimum) of the building occupants to enable adjustments to meet individual needs and preferences. Operable windows may be used in lieu of controls for occupants located 20 feet (6 meters) inside and 10 feet (3 meters) to either side of the operable part of a window. The areas of operable window must meet the following requirements:
- The openable area must be at least 4% of the net occupiable floor area. If an opening is covered with louvers or otherwise partially obstructed, calculate the openable area based on the free, unobstructed area.
- If an interior space without direct openings to the outdoors is ventilated through an adjoining room, the opening between the rooms must be permanently unobstructed and be at least 8% of the area of the interior room or 25 square feet (2 square meters).
- Whenever the space is occupied, building occupants must have a readily accessible way to control the opening.

Provide comfort system controls for all shared multi-occupant spaces to enable adjustments that meet group needs and preferences.

Use the thermal comfort conditions as described in ASHRAE standard 55-2004 (with errata but without addenda) with respect to the primary factors of air temperature, radiant temperature, air speed and humidity. **(OR)** Define thermal comfort conditions through an alternative Local standard by demonstrating equivalency to ASHRAE 55-2004 with respect to the above primary factors.

Potential Technologies & Strategies

Design the building and systems with comfort controls to allow adjustments to suit individual needs or those of groups in shared spaces. Identify the factors of thermal comfort and a process for developing comfort criteria for building spaces that suit the needs of the occupants involved in their daily activities. Control strategies can be developed to expand on the comfort criteria and enable individuals to make adjustments to suit their needs and preferences. These strategies may involve system designs incorporating operable windows, hybrid systems integrating operable windows and mechanical systems, or mechanical systems alone. Individual adjustments may involve individual thermostat controls, local diffusers at floor, desk or overhead levels, control of individual radiant panels or other means integrated into the overall building, thermal comfort systems and energy systems design. Designers should evaluate the closely tied interactions between thermal comfort and acceptable indoor air quality, whether natural or mechanical ventilation.

[29] For the purposes of this credit, comfort system control is defined as control over at least 1 of the following primary factors in the occupant's vicinity: air temperature, radiant temperature, air speed and humidity.

IEQ Credit 7.1: Thermal Comfort—Design

1 Point

Intent

To provide a comfortable thermal environment that promotes occupant productivity and well-being.

Requirements

Design heating, ventilating and air conditioning (HVAC) systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Comfort Conditions for Human Occupancy (with errata but without addenda[30]). Demonstrate design compliance in accordance with the Section 6.1.1 documentation.

OR

Demonstrate performance by using a local standard that has equivalent requirements to ASHRAE Standard 55–2004 by setting appropriate benchmarks and metrics for establishing a baseline, and measure performance relative to that baseline. The following guidelines outline the methodology for establishing acceptable benchmarks and metrics pertaining to this credit's requirements:

- Address any adjustments to thermal comfort parameters described by ASHRAE 55–2004.
- Demonstrate design compliance in accordance with the documentation described in ASHRAE Standard 55–2004, Section 6.1.1.

Potential Technologies & Strategies

Establish comfort criteria according to ASHRAE 55-2004 (with errata but without addenda) or equivalent local standard that support the desired quality and occupant satisfaction with building performance. Design the building envelope and systems with the capability to meet the comfort criteria under expected environmental and use conditions. Evaluate air temperature, radiant temperature, air speed and relative humidity in an integrated fashion, and coordinate these criteria with IEQ Prerequisite 1: Minimum IAQ Performance, IEQ Credit 1: Outdoor Air Delivery Monitoring, and IEQ Credit 2: Increased Ventilation.

[30] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

IEQ Credit 7.2: Thermal Comfort—Verification

1 point in addition to IEQ credit 7.1

Intent

To provide for the assessment of building occupant thermal comfort over time.

Requirements

Achieve IEQ Credit 7.1: Thermal Comfort—Design

Provide a permanent monitoring system to ensure that building performance meets the desired comfort criteria as determined by IEQ Credit 7.1: Thermal Comfort—Design.

Agree to conduct a thermal comfort survey of building occupants within 6 to 18 months after occupancy. This survey should collect anonymous responses about thermal comfort in the building, including an assessment of overall satisfaction with thermal performance and identification of thermal comfort-related problems. Agree to develop a plan for corrective action if the survey results indicate that more than 20% of occupants are dissatisfied with thermal comfort in the building. This plan should include measurement of relevant environmental variables in problem areas in accordance with ASHRAE Standard 55-2004 (with errata but without addenda[31]) **(OR)** equivalent local standard.

Residential projects are not eligible for this credit.

Potential Technologies & Strategies

ASHRAE 55-2004 provides guidance for establishing thermal comfort criteria and documenting and validating building performance to the criteria. While the standard is not intended for purposes of continuous monitoring and maintenance of the thermal environment, the principles expressed in the standard provide a basis for the design of monitoring and corrective action systems.

[31] Project teams wishing to use ASHRAE approved addenda for the purposes of this credit may do so at their discretion. Addenda must be applied consistently across all LEED credits.

IEQ Credit 8.1: Daylight and Views—Daylight

1 Point

Intent

To provide building occupants with a connection between indoor spaces and the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirements

Through 1 of the 4 options, achieve daylighting in at least the following spaces:

Regularly Occupied Spaces	Points
75%	1

OPTION 1. Simulation

Demonstrate through computer simulation that the applicable spaces achieve daylight illuminance levels of a minimum of 25 footcandles (fc) (270 lux) and a maximum of 500 fc (5,400 lux) in a clear sky condition on September 21 at 9 a.m. and 3 p.m. Areas with illuminance levels below or above the range do not comply. However, designs that incorporate view-preserving automated shades for glare control may demonstrate compliance for only the minimum 25 fc (270 lux) illuminance level.

OR

OPTION 2. Prescriptive

Use a combination of side-lighting and/or top-lighting to achieve a total daylighting zone (the floor area meeting the following requirements) that is at least 75% of all the regularly occupied spaces.

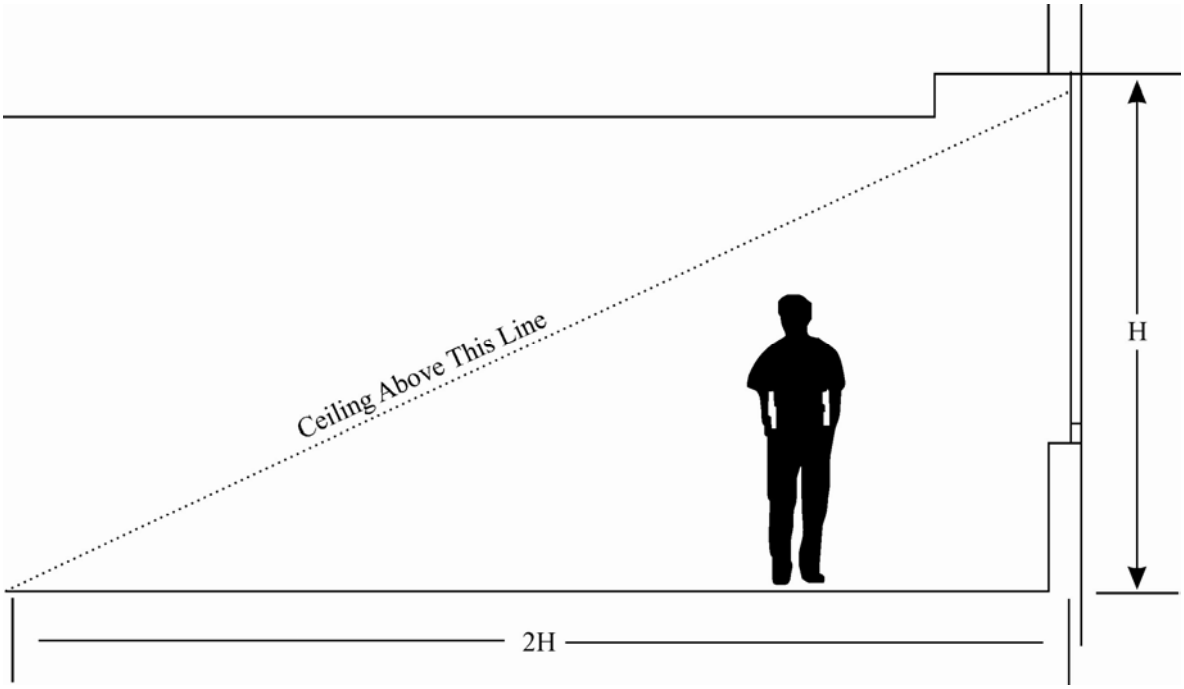
For the Side-lighting Daylight Zone (see diagram on the next page):

- Achieve a value, calculated as the product of the visible light transmittance (VLT) and window-to-floor area ratio (WFR) of daylight zone between 0.150 and 0.180. The window area included in the calculation must be at least 30 inches (.8 meters) above the floor.

0.150	<	VLT	x	WFR	<	0.180

- The ceiling must not obstruct a line in section that joins the window-head to a line on the floor that is parallel to the plane of the window; is twice the height of the window-head above the floor in, distance from the plane of the glass as measured perpendicular to the plane of the glass.

- Provide sunlight redirection and/or glare control devices to ensure daylight effectiveness.



For Top-lighting Daylight Zone (see diagram on the next page):

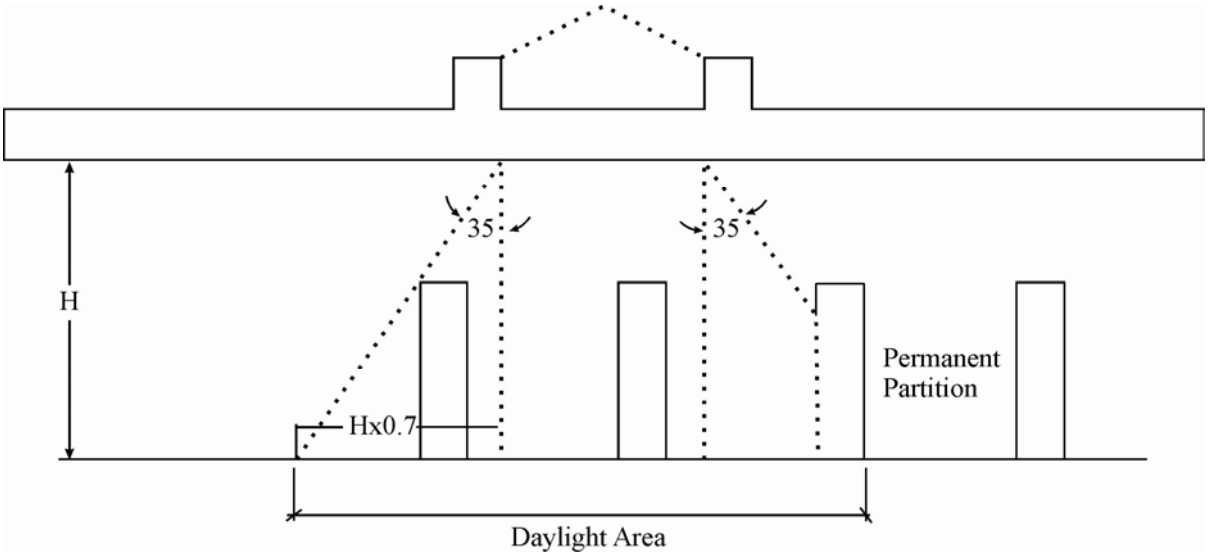
- The daylight zone under a skylight is the outline of the opening beneath the skylight, plus in each direction the lesser of:
- 70% of the ceiling height,

OR

- 1/2 the distance to the edge of the nearest skylight,

OR

- The distance to any permanent opaque partition (if transparent show VLT) farther than 70% of the distance between the top of the partition and the ceiling.
- Achieve skylight roof coverage between 3% and 6% of the roof area with a minimum 0.5 VLT.
- The distance between the skylights must not be more than 1.4 times the ceiling height.
- A skylight diffuser, if used, must have a measured haze value of greater than 90% when tested according to ASTM D1003. Avoid direct line of sight to the skylight diffuser.
- Exceptions for areas where tasks would be hindered by the use of daylight will be considered on their merits.



OR

OPTION 3. Measurement

Demonstrate through records of indoor light measurements that a minimum daylight illumination level of 25 fc (270 lux) has been achieved in the applicable spaces. Measurements must be taken on a 10-foot (3-meter) grid for all occupied spaces and recorded on building floor plans. Only the floor area associated with the portions of rooms or spaces meeting the minimum illumination requirements may be counted in the calculations.

For all projects pursuing this option, provide daylight redirection and/or glare control devices to avoid high-contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by daylight will be considered on their merits.

OR

OPTION 4. Combination

Any of the above calculation methods may be combined to document the minimum daylight illumination in the applicable spaces. The different methods used in each space must be clearly recorded on all building plans.

In all cases, only the floor area associated with the portions of rooms or spaces meeting the requirements may be applied toward the 75% of total area calculation required to qualify for this credit.

In all cases, provide glare control devices to avoid high-contrast situations that could impede visual tasks. Exceptions for areas where tasks would be hindered by the use of daylight will be considered on their merits.

Potential Technologies & Strategies

Design the building to maximize interior daylighting. Strategies to consider include building orientation, shallow floor plates, increased building perimeter, exterior and interior permanent shading devices, high-performance glazing, and high-ceiling reflectance values; additionally, automatic photocell-based controls can help to reduce energy use. Predict daylight factors via manual calculations or model daylighting strategies with a physical or computer model to assess footcandle (lux) levels and daylight factors achieved.

IEQ Credit 8.2: Daylight and Views—Views

1 Point

Intent

To provide building occupants a connection to the outdoors through the introduction of daylight and views into the regularly occupied areas of the building.

Requirements

Achieve a direct line of sight to the outdoor environment via vision glazing between 30 inches and 90 inches (between 0.8 meters and 2.3 meters) above the finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with a direct line of sight by totaling the regularly occupied floor area that meets the following criteria:

- In plan view, the area is within sight lines drawn from perimeter vision glazing.
- In section view, a direct sight line can be drawn from the area to perimeter vision glazing.

The line of sight may be drawn through interior glazing. For private offices, the entire floor area of the office may be counted if 75% or more of the area has a direct line of sight to perimeter vision glazing. For multi-occupant spaces, the actual floor area with a direct line of sight to perimeter vision glazing is counted.

Potential Technologies & Strategies

Design the space to maximize daylighting and view opportunities. Strategies to consider include lower partitions, interior shading devices, interior glazing and automatic photocell-based controls.

INNOVATION IN DESIGN

ID Credit 1: Innovation in Design

1–5 Points

Intent

To provide design teams and projects the opportunity to achieve exceptional performance above the requirements set by the LEED Green Building Rating System and/or innovative performance in Green Building categories not specifically addressed by the LEED Green Building Rating System.

Requirements

Credit can be achieved through any combination of the Innovation in Design and Exemplary Performance paths as described below:

PATH 1. Innovation in Design (1-5 points)

Achieve significant, measurable environmental performance using a strategy not addressed in the LEED 2011 for New Construction and Major Renovations Rating System.

One point is awarded for each innovation achieved. No more than 5 points under IDc1 may be earned through PATH 1—Innovation in Design.

Identify the following in writing:

- The intent of the proposed innovation credit.
- The proposed requirement for compliance.
- The proposed submittals to demonstrate compliance.
- The design approach (strategies) used to meet the requirements.

PATH 2. Exemplary Performance (1-3 points)

Achieve exemplary performance in an existing LEED 2011 for New Construction and Major Renovations prerequisite or credit that allows exemplary performance as specified in the LEED Reference Guide for Green Building Design & Construction. An exemplary performance point may be earned for achieving double the credit requirements and/or achieving the next incremental percentage threshold of an existing credit in LEED.

One point is awarded for each exemplary performance achieved. No more than 3 points under IDc1 may be earned through PATH 2— Exemplary Performance.

Potential Technologies & Strategies

Substantially exceed a LEED 2011 for New Construction and Major Renovations performance credit such as energy performance or water efficiency. Apply strategies or measures that demonstrate a comprehensive approach and quantifiable environment and/or health benefits.

ID Credit 2: LEED Accredited Professional

1 Point

Intent

To support and encourage the design integration required by LEED to streamline the application and certification process.

Requirements

At least 1 principal participant of the project team shall be a LEED Accredited Professional (AP).

Potential Technologies & Strategies

Educate the project team members about green building design and construction, the LEED requirements and application process early in the life of the project. Consider assigning integrated design and construction process facilitation to the LEED AP.

REGIONAL PRIORITY

RP Credit 1: Regional Priority

1–4 Points

Intent

To provide an incentive for the achievement of credits that address geographically-specific environmental priorities.

Requirements

Earn up to four of the six Regional Priority (RP) credits identified as having environmental importance for projects in the Indian region. These six RP credits are listed below.

- WE c1: Water Efficient Landscaping
- WE c2: Innovative Wastewater Treatment and Reuse
- WE c3: Water Use Reduction
- EA c1: Optimize Energy Performance
- EA c3: Enhanced Commissioning
- EA c5: Measurement and Verification

One bonus point is awarded for each Regional Priority credit achieved; no more than four credits identified as Regional Priority credits may be earned.

Potential Technologies & Strategies

Determine and pursue the prioritized credits for the project location.

About CII-Godrej GBC

CII – Sohrabji Godrej Green Business Centre (CII – Godrej GBC), a division of Confederation of Indian Industry (CII) is India's premier developmental institution, offering advisory services to the industry on environmental aspects and works in the areas of Green Buildings, Energy Efficiency, Water Management, Renewable Energy, Green Business Incubation and Climate Change activities.

The Centre sensitises key stakeholders to embrace green practices and facilitates market transformation, paving way for India to become one of the global leaders in green businesses by 2015.

About IGBC (Indian Green Building Council)

The Indian Green Building Council (IGBC), part of Confederation of Indian Industry (CII) was formed in the year 2001. The vision of the council is to usher in a green building movement in India and facilitate India to become one of the global leaders in green buildings.

The council offers a wide array of services which include developing new green building rating programmes, certification services and green building training programmes. The council also organises Green Building Congress, its annual flagship event on green buildings.

The council is committee-based, member- driven and consensus-focused. All the stakeholders of construction industry comprising of architects, developers, product manufacturers, corporate, Government, academia and nodal agencies participate in the council activities through local chapters.

Confederation of Indian Industry
CII-Sohrabji Godrej Green Business Centre

Survey No. 64, Kothaguda Post, near HITEC City,
Ranga Reddy Dist., Hyderabad - 500 084
Tel. Nos. +91 40 4418 5111, Fax No. +91 40 2311 2837
E-mail: igbc@cii.in | website: www.igbc.in