LEED® for Schools

for New Construction and Major Renovations

Approved 2007 Version

April 2007

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Certification Levels	**79 Possible Points**
Certified: 29-36 points	
Silver: 37-43 points	
Gold: 44-57 points	
Platinum: 58-79 points	

Introduction

Leadership in Energy and Environmental Design (LEED®)

Buildings fundamentally impact people's lives and the health of the planet. In the United States, buildings use one-third of our total energy, two-thirds of our electricity, one-eighth of our water, and transform land that provides valuable ecological resources. Since the LEED Green Building Rating System for New Construction (LEED-NC version 2.0) was first published in 1999, it has been helping professionals across the country to improve the quality of our buildings and their impact on the environment.

As the green building sector grows exponentially, more and more building professionals, owners, and operators are seeing the benefits of green building and LEED certification. Green design not only makes a positive impact on public health and the environment, it also reduces operating costs, enhances building and organizational marketability, potentially increases occupant productivity, and helps create a sustainable community. LEED fits into this market by providing rating systems that are voluntary, consensus-based, market-driven, based on accepted energy and environmental principles, and they strike a balance between established practices and emerging concepts.

The LEED rating systems are developed by USGBC committees, in adherence with USGBC policies and procedures guiding the development and maintenance of rating systems. LEED for Schools is only possible due to the generous volunteer efforts of many individuals, and has been in development for over 3 years. LEED for Schools is one of a growing portfolio of rating systems serving specific market sectors.

LEED for Schools

The LEED for Schools Rating System recognizes the unique nature of the design and construction of K-12 schools. Based on LEED for New Construction, it addresses issues such as classroom acoustics, master planning, mold prevention, and environmental site assessment. By addressing the uniqueness of school spaces and children's health issues, LEED for Schools provides a unique, comprehensive tool for schools that wish to build green, with measurable results. LEED for Schools is the recognized third-party standard for high performance schools that are healthy for students, comfortable for teachers, and cost-effective.

The LEED for Schools Rating System is most applicable to new construction and major renovation projects in K-12 educational spaces. Other projects, such as university educational buildings, K-12 athletic facilities, or interpretive centers, may choose to use LEED for Schools if they wish.

Why Certify?

While LEED Rating Systems can be useful just as tools for building professionals, there are many reasons why LEED project certification can be an asset:

- Be recognized for your commitment to environmental issues in your community, your organization (including stockholders), and your industry;
- Receive third party validation of achievement;
- Qualify for a growing array of state & local government initiatives;

- Receive marketing exposure through USGBC Web site, Greenbuild conference, case studies, and media announcements.

Registration

Project teams interested in obtaining LEED certification for their project must first register online. Registration during early phases of the project will ensure maximum potential for certification. The LEED web site, www.leedbuilding.org, contains important details about the certification review process, schedule and fees. The applicant project must satisfactorily document achievement of all the prerequisites and a minimum number of points. See the LEED for Schools project checklist for the number of points required to achieve LEED for Schools rating levels.

Additional Resources

Visit the LEED Web site for available tools and support, such as the LEED for Schools Reference Guide, which is essentially an expanded version of this document that includes approach & implementation, calculation information, and other supplemental resources (essential for all LEED for Schools project teams). Also available online are fact sheets, case studies, technical support via Credit Interpretations, information on LEED training workshops, and more.

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Sustainable Sites

SS Prerequisite 1: Construction Activity Pollution Prevention Required

Intent

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

Requirements

Create and implement an Erosion and Sedimentation Control (ESC) Plan for all construction activities associated with the project. The ESC Plan shall conform to the erosion and sedimentation requirements of the 2003 EPA Construction General Permit OR local erosion and sedimentation control standards and codes, whichever is more stringent. The Plan shall describe the measures implemented to accomplish the following objectives:

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

The Construction General Permit (CGP) outlines the provisions necessary to comply with Phase I and Phase II of the National Pollutant Discharge Elimination System (NPDES) program. While the CGP only applies to construction sites greater than 1 acre, the requirements are applied to all projects for the purposes of this prerequisite. Information on the EPA CGP is available at: http://cfpub.epa.gov/npdes/stormwater/cgp.cfm.

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, earth dikes, silt fencing, sediment traps and sediment basins.

SS Prerequisite 2: Environmental Site Assessment

Required

Intent

Ensure that the site is assessed for environmental contamination and if contaminated, that the environmental contamination has been remediated to protect children's health.

Requirements

Conduct a Phase I Environmental Site Assessment (as described in ASTM E1527-05) to determine if environmental contamination exists at the site. If contamination is suspected conduct a Phase II Environmental Site Assessment (as described in ASTM E1903-97 (2002)).

AND

Sites that are contaminated due to the past existence of a landfill on the site are prohibited. If the site is otherwise contaminated, then it must be remediated to meet local, state, or federal EPA region residential (unrestricted) standards whichever is most stringent. Documentation from the authority must be provided (such as EPA's "Ready for Reuse" document) to prove "safe" levels of contamination have been achieved. As the remediation process leads to significant environmental benefit, **one point** (in SS credit 3) will be given for successful documented remediation of the site.

Potential Technologies and Strategies

To discover if the site has any chemical contaminants, research current and past site land using:

- Federal, state and local regulatory agencies' databases and files.
- Private records of current and past land uses
- Review historical aerial photographs
- Review privately held environmental databases
- Conduct interviews with people familiar with the site's history (including past and present owners).

Many local agencies have databases regarding the use of the land. For example, Oregon Department of Environmental Quality has a database of buried fossil fuel storage tanks. This Department also has other databases (e.g., dry cleaner locations) that can be used to determine the historical usage of the site. These lists can be compiled to determine if potential environmental contaminants exist at the schools proposed site.

Develop and implement a site remediation plan using strategies such as pump-and-treat, bioreactors, land farming and in-situ remediation. Contact your state environmental protection agency to find out about remediation standards for residential (unrestricted) use. It is strongly recommended that projects use standards equivalent or more stringent than EPA Region 9 clean-up standards, as these are set at the most appropriate level for protecting children's health and safety.

SS Credit 1: Site Selection

1 Point

Intent

Avoid 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 one of the following criteria:

- Prime farmland as defined by the United States Department of Agriculture in the United States Code of Federal Regulations, Title 7, Volume 6, Parts 400 to 699, Section 657.5 (citation 7CFR657.5)
- Previously undeveloped land whose elevation is lower than 5 feet above the elevation of the 100-year flood as defined by FEMA (Federal Emergency Management Agency)
- Land that is specifically identified as habitat for any species on Federal or State threatened or endangered lists
- Within 100 feet of any wetlands as defined by United States Code of Federal Regulations 40 CFR, Parts 230-233 and Part 22, and isolated wetlands or areas of special concern identified by state or local rule, OR within setback distances from wetlands prescribed in state or local regulations, as defined by local or state rule or law, whichever is more stringent
- Previously undeveloped land that is within 50 feet of a water body, defined as seas, lakes, rivers, streams and tributaries which support or could support fish, recreation or industrial use, consistent with the terminology of the Clean Water Act
- Land which prior to acquisition for the project was public parkland, unless land of equal or greater value as parkland is accepted in trade by the public landowner (Park Authority projects are exempt)

Potential Technologies & Strategies

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

SS Credit 2: Development Density & Community Connectivity
1 Point

Intent

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

Requirements

OPTION 1 — DEVELOPMENT DENSITY

Construct or renovate building on a previously developed site AND in a community with a minimum development density of 60,000 square feet per acre net (Note: density calculation must include the area of the project being built and is based on a typical two-story downtown development).

For the purposes of this option, physical education spaces that have been included as part of the project site such as playing fields and associated buildings used during sporting events only (such as concession stands) and playgrounds with play equipment are excluded from the development density calculations.

OR

OPTION 2 — COMMUNITY CONNECTIVITY

Construct or renovate building on a previously developed site AND within 1/2 mile of a residential zone or neighborhood with an average density of 10 units per acre net AND within 1/2 mile of at least 10 Basic Services AND with pedestrian access between the building and the services.

Basic Services include, but are not limited to:

> 1) Bank; 2) Place of Worship; 3) Convenience Grocery; 4) Day Care; 5) Cleaners; 6) Fire Station; 7) Beauty; 8) Hardware; 9) Laundry; 10) Library; 11) Medical/Dental; 12) Senior Care Facility; 13) Park; 14) Pharmacy; 15) Post Office; 16) Restaurant; 17) Other Schools or Universities; 18) Supermarket; 19) Theater; 20) Community Center; 21) Fitness Center; 22) Museum.

Proximity is determined by drawing a 1/2 mile radius around any building entrance on a site map and counting the services within that radius.

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

Rehabilitate damaged sites where development is complicated by environmental contamination, reducing pressure on undeveloped land.

Requirements

Projects can only obtain this point via SS prerequisite 2, by remediating site contamination.

Potential Technologies & Strategies

Identify tax incentives and property cost savings. Coordinate site development plans with remediation activity, as appropriate.

SS Credit 4.1: Alternative Transportation: Public Transportation Access
1 Point

Intent

Reduce pollution and/or land development impacts from individual automobile use.

Requirements

Locate project within 1/2 mile of an existing, or planned and funded, commuter rail, light rail, or subway station.

OR

Locate project within 1/4 mile of one or more stops for two or more public or campus bus lines usable by building occupants. A school bus system may count as one of these lines.

OR

Show that the school where the project is located has an attendance boundary that at least 80% of students live within no more than 3/4 mile for Grades 8 and below, and 1.5 mile for Grades 9 and above. In addition, locate the project on a site that allows pedestrian access to the site from all residential neighborhoods that house the planned student population.

AND in all cases, provide dedicated walking or bike routes to the transit that extend from the school building at least to the end of the school property in 2 or more different directions, ensuring that walking routes and bike lanes have no barriers on school property (i.e. fences).

Potential Technologies & Strategies

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

SS Credit 4.2: Alternative Transportation: Bicycle Use
1 Point

Intent

Reduce pollution and/or land development impacts from individual automobile use.

Requirements

Provide secure bicycle racks and/or storage (within 200 yards of a building entrance) for 5% or more of all building staff and students above third grade level (measured at peak periods).

AND provide shower and changing facilities in the building, or within 200 yards of a building entrance, for 0.5% of Full-Time Equivalent (FTE) staff.

AND provide dedicated bike lanes that extend at least to the end of the school property in 2 or more different directions, ensuring that bike lanes have no barriers on school property (i.e. fences).

Potential Technologies & Strategies

Design the building with transportation amenities such as bicycle racks and showering/changing facilities. School administrators should be aware of issues with students and staff sharing showering/changing facilities, and ensure that both groups have access to facilities and feel comfortable using them. Administrators may consider providing separate shower facilities if there are no programmatic ways to provide privacy for staff in shared showering/changing facilities.

SS Credit 4.3: Alternative Transportation: Low Emitting & Fuel Efficient Vehicles
1 Point

Intent

Reduce pollution and/or land development impacts from individual automobile use.

Requirements

OPTION 1

Develop and implement a plan for the buses and maintenance vehicles serving the school to use 20% natural gas, propane, biodiesel or be low-emitting and fuel-efficient vehicles.

OR

OPTION 2

Provide preferred parking for 5% of the total vehicle parking capacity of the site and at least one designated carpool drop-off area for low-emitting and fuel-efficient vehicles.

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 the California Air Resources Board or have achieved a minimum green score of 40 on the American Council for an Energy Efficient Economy (ACEEE) annual vehicle rating guide.

"Preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.

Potential Technologies & Strategies

Provide transportation amenities such as alternative fuel refueling stations. Consider sharing the costs and benefits of refueling stations with neighbors. Using B-20 biodiesel in all buses and maintenance vehicles is one way to obtain this point through option 1.

SS Credit 4.4: Alternative Transportation: Parking Capacity
1 Point

Intent

Reduce pollution and/or land development impacts from individual automobile use.

Requirements

OPTION 1

Size parking capacity to not exceed, minimum local zoning requirements, AND, provide preferred parking for carpools or vanpools for 5% of the total provided parking spaces.

OR

OPTION 2

Provide no new parking.

OR

OPTION 3

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 www.ite.org).

"Preferred parking" refers to the parking spots that are closest to the main entrance of the project (exclusive of spaces designated for handicapped) or parking passes provided at a discounted price.

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.

SS Credit 5.1: Site Development: Protect or Restore Habitat
1 Point

Intent

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

Requirements

OPTION 1

On greenfield sites, limit all site disturbance to 40 feet beyond the building perimeter; 10 feet beyond surface walkways, patios, surface parking and utilities less than 12 inches in diameter; 15 feet beyond primary roadway curbs and main utility branch trenches; and 25 feet beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities and playing fields) that require additional staging areas in order to limit compaction in the constructed area.

OR

OPTION 2

On previously developed or graded sites, restore or protect a minimum of 50% of the site area (excluding the building footprint) with native or adapted vegetation. Native/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. Projects earning SS Credit 2 and using vegetated roof surfaces may apply the vegetated roof surface to this calculation if the plants meet the definition of native/adapted.

Greenfield sites are those that are not previously developed or graded and remain in a natural state. Previously developed sites are those that previously contained buildings, roadways, parking lots, or were graded or altered by direct human activities.

Potential Technologies & Strategies

On greenfield sites, perform a site survey to identify site elements and adopt a master plan for development of 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 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, utilize local and regional governmental agencies, consultants, educational facilities, and native plant societies as resources for the selection of appropriate native or adapted plant materials. Prohibit plant materials listed as invasive or noxious weed species. Native/adapted plants require minimal or no irrigation following establishment, 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.

SS Credit 5.2: Site Development: Maximize Open Space
1 Point

Intent

Provide a high ratio of open space to development footprint to promote biodiversity.

Requirements

OPTION 1

Reduce the development footprint (defined as the total area of the building footprint, hardscape, access roads and parking) and/or provide vegetated open space within the project boundary to exceed the local zoning's open space requirement for the site by 25%.

OR

OPTION 2

For areas with no local zoning requirements (e.g., some university campuses, military bases), provide vegetated open space area adjacent to the building that is equal to the building footprint.

OR

OPTION 3

Where a zoning ordinance exists, but there is no requirement for open space (zero), provide vegetated open space equal to 20% of the project's site area.

ALL OPTIONS:

- For projects located in urban areas that earn SS Credit 2, vegetated roof areas can contribute to credit compliance.
- For projects located in urban areas that earn SS Credit 2, 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 if 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 development of the project site. Select a suitable building location and design the building with a minimal footprint to minimize site disruption. Strategies include stacking the building program, tuck-under parking and sharing facilities with neighbors to maximize open space on the site.

SS Credit 6.1: Stormwater Design: Quantity Control
1 Point

Intent

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

Requirements

CASE 1 — EXISTING IMPERVIOUSNESS IS LESS THAN OR EQUAL TO 50%

Implement a stormwater management plan that prevents the post-development peak discharge rate and quantity from exceeding the pre-development peak discharge rate and quantity for the one- and two-year 24-hour design storms.

OR

Implement a stormwater management plan that protects receiving stream channels from excessive erosion by implementing a stream channel protection strategy and quantity control strategies.

OR

CASE 2 — EXISTING IMPERVIOUSNESS IS GREATER THAN 50%

Implement a stormwater management plan that results in a 25% decrease in the volume of stormwater runoff from the two-year 24-hour design storm.

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 volumes generated 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

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[1] 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. BMPs are considered to meet these criteria if (1) they are designed in accordance with standards and specifications from a state or local program that has adopted these performance standards, or (2) there exists in-field performance monitoring data demonstrating compliance with the criteria. Data must conform to accepted protocol (e.g., Technology Acceptance Reciprocity Partnership [TARP], Washington State Department of Ecology) for BMP monitoring.

Potential Technologies & Strategies

Use alternative surfaces (e.g., vegetated roofs, pervious pavement or grid pavers) and nonstructural techniques (e.g., rain gardens, vegetated swales, disconnection of imperviousness, rainwater recycling) to reduce imperviousness and promote infiltration thereby reducing pollutant loadings. Consider pervious materials for physical education spaces, such as wood mulch, recycled rubber mulch, and pervious paving.

Use sustainable design strategies (e.g., Low Impact Development, Environmentally Sensitive Design) to design integrated natural and mechanical treatment systems such as constructed wetlands, vegetated filters, and open channels to treat stormwater runoff.

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[1] In the United States, there are three distinct climates that influence the nature and amount of rainfall occurring on an annual basis. Humid watersheds are defined as those that receive at least 40 inches of rainfall each year, Semi-arid watersheds receive between 20 and 40 inches of rainfall per year, and Arid watersheds receive less than 20 inches of rainfall per year. For this credit, 90% of the average annual rainfall is equivalent to treating the runoff from:

(a) Humid Watersheds – 1 inch of rainfall;
(b) Semi-arid Watersheds – 0.75 inches of rainfall; and
(c) Arid Watersheds – 0.5 inches of rainfall.

SS Credit 7.1: Heat Island Effect: Non-Roof
1 Point

Intent

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirements

OPTION 1

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

- Shade (within 5 years of occupancy)
- Paving materials with a Solar Reflectance Index (SRI)[2] of at least 29
- Open grid pavement system

OR

OPTION 2

Place a minimum of 50% of parking spaces under cover (defined as under ground, under deck, under roof, or under a building). Any roof used to shade or cover parking must have an SRI of at least 29.

Potential Technologies & Strategies

Shade constructed surfaces on the site with landscape features and utilize high-reflectance materials for hardscape. Consider replacing constructed surfaces (i.e. roof, roads, sidewalks, etc.) with vegetated surfaces such as vegetated roofs and open grid paving or specify high-albedo materials to reduce the heat absorption.

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2 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 (reflectance 0.05, emittance 0.90) is 0 and a standard white (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 1980-01. 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. Default values for some materials will be available in the LEED-NC v2.2 Reference Guide.

SS Credit 7.2: Heat Island Effect: Roof
1 Point

Intent

Reduce heat islands (thermal gradient differences between developed and undeveloped areas) to minimize impact on microclimate and human and wildlife habitat.

Requirements

OPTION 1

Use roofing materials having a Solar Reflectance Index (SRI)[3] equal to or greater than the values in the table below for a minimum of 75% of the roof surface.
OR

OPTION 2

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

OR

OPTION 3

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

(Area of SRI Roof / 0.75) + (Area of vegetated roof / 0.5) >= Total Roof Area

Roof Type	Slope	SRI
Low-Sloped Roof	**≤ 2:12**	**78**
Steep-Sloped Roof	**> 2:12**	**29**

Potential Technologies & Strategies

Consider installing high-albedo and vegetated roofs to reduce heat absorption. 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. Default values will be available in the LEED-NC v2.2 Reference Guide. Product information is available from the Cool Roof Rating Council website, at www.coolroofs.org.

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[3] 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 (reflectance 0.05, emittance 0.90) is 0 and a standard white (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.

SS Credit 8: Light Pollution Reduction

1 Point

Intent

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 on nocturnal environments.

Requirements

FOR INTERIOR LIGHTING

All non-emergency interior lighting, with a direct line of sight to any openings in the envelope (translucent or transparent), shall have its input power reduced (by automatic device) by at least 50% between the hours of 11 PM and 5 AM. After hours override may be provided by a manual or occupant sensing device provided that the override last no more than 30 minutes.

OR

All openings in the envelope (translucent or transparent) with a direct line of sight to any non-emergency lighting shall have shielding (for a resultant transmittance of less than 10%) that will be controlled/closed by automatic device between the hours of 11 PM and 5 AM.

AND

FOR EXTERIOR LIGHTING, excluding physical education spaces

Only light areas as required for safety and comfort. Do not exceed 80% of the lighting power densities for exterior areas and 50% for building facades and landscape features as defined in ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments. Meet exterior lighting control requirements from ASHRAE/IESNA Standard 90.1-2004, Exterior Lighting Section, without amendments.

All projects shall be classified under one of the following zones, as defined in IESNA RP-33, and shall follow all of the requirements for that specific zone:

LZ1 — Dark (Park and Rural Settings)

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 at the site boundary and beyond. Document that 0% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down).

LZ2 — Low (Residential areas)

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 at the site boundary and no greater than 0.01 horizontal and vertical footcandles 10 feet beyond the site boundary. Document that no more than 2% of the total initial designed fixture lumens are emitted

at an angle of 90 degrees or higher from nadir (straight down). 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.

LZ3 — Medium (Commercial/Industrial, 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 at the site boundary and no greater than 0.01 horizontal and vertical footcandles 15 feet beyond the site. Document that no more than 5% of the total initial designed fixture lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). 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.

LZ4 — High (Major City Centers, Entertainment Districts)
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 at the site boundary and no greater than 0.01 horizontal and vertical footcandles 15 feet beyond the site. Document that no more than 10% of the total initial designed site lumens are emitted at an angle of 90 degrees or higher from nadir (straight down). 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.

Sports Field Lighting (Physical Education Spaces)
Automatic Shutoff: All sports lighting shall be automatically controlled to shut off no later than 11PM. Manual override shall be provided to avoid disruption of school sponsored sporting events.

Trespass Calculations: All trespass calculations shall be submitted for two conditions: (1) With the sports lighting turned off and all other site lighting turned on, the light trespass requirements are as stated above, and (2) with just the sports lighting on, the light trespass requirements for horizontal and vertical footcandles may be increased to the following illuminance levels:

LZ1 = 0.10
LZ2 = 0.30
LZ3 = 0.80
LZ4 = 1.50

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 model the site lighting using a computer model. Technologies to reduce light pollution include full cutoff luminaires, low-reflectance surfaces and low-angle spotlights.

Note that physical education spaces (playing fields) do not need to comply with the lighting power density requirements of this credit, as per ASHRAE 90.1 section 9.4.5, exception E.

SS Credit 9: Site Master Plan

1 Point

Intent

Ensure the environmental site issues included in the initial development of the site and project are continued throughout future development due to changes in programs or demography.

Requirements

The project must achieve at least 4 out of the 7 following credits using the traditional calculation methods, and then this credit requires that the achieved credits be recalculated using the data from the master plan. The seven credits include:

Credit 1	Site Selection
Credit 5.1	Site Development, Protect or Restore Habitat
Credit 5.2	Site Development, Maximize Open Space
Credit 6.1	Stormwater Design, Quantity Control
Credit 6.2	Stormwater Design, Quality Control
Credit 7.1	Heat Island Effect, Non-Roof
Credit 8	Light Pollution Reduction

AND

A site master plan for the school must be developed in collaboration with the school board or other decision-making body. Previous sustainable site design measures should be considered in all master-planning efforts, with intent to retain existing infrastructure whenever possible. The master plan, therefore, must include current construction activity plus future construction (within the building's lifespan) that affects the site. The master plan development footprint shall also include parking, paving, and utilities.

Potential Technologies & Strategies

Site Development should include all potential expansion of the school to accommodate future needs while adhering and maintaining the environmental site conditions referenced above and explicitly noted on the site plan as future expansion. Include in this Master Plan locations of temporary classroom facilities that will not impact the selected environmental conditions. Use of GIS data and other similar technologies should be used to establish the site capacity and characteristics. Design considerations should include future vertical or horizontal HVAC, electrical and structural loads based on the master plan.

SS Credit 10: Joint Use of Facilities

1 Point

Intent

Make the school a more integrated part of the community by enabling the building and its playing fields to be used for non-school events and functions.

Requirements

OPTION 1

In collaboration with the school board or other decision-making body, ensure that at least three (3) of the following spaces included in the school are accessible to and available for shared use by the general public: Auditorium; Gymnasium; Cafeteria/Cafetorium; one or more Classrooms; Playing Fields; Joint Parking.

OPTION 2

In collaboration with the school board or other decision-making body, engage in a contract with community or other organizations to provide at least two (2) dedicated-use spaces in the building. Dedicated-use spaces include, but are not limited to:

1) Commercial Office; 2) Health Clinic; 3) Community Service Centers (provided by state, city, or county offices); 4) Police Offices; 5) Library/media center; 6) Parking lot, 7) One or more commercial sector businesses; etc.

FOR OPTION 1 AND 2: Provide a separate entry to the spaces intended for joint use. The entry can be from a school lobby or corridor near an entrance convenient to public access which can be secured from the rest of the school after normal school hours and which has toilets available.

OPTION 3

In collaboration with the school district or other decision-making body, ensure that at least two of the following six (6) spaces that are owned by other organizations/agencies are accessible to students: Auditorium; Gymnasium; Cafeteria; one or more Classrooms; Swimming Pools; Playing Fields. Provide direct pedestrian access to these spaces from the school. In addition, provide signed agreements with the other organizations/agencies that stipulate how the school district and organizations/agencies will share these spaces.

Potential Technologies & Strategies

Contact other public agencies and organizations that may wish to use school facilities. For example, Parks and Recreation Departments may need use of additional fields while school district may need use of a community pool.

Water Efficiency

WE Credit 1.1: Water Efficient Landscaping: Reduce by 50%
1 Point

Intent

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

Reduce potable water consumption for irrigation by 50% from a calculated mid-summer baseline case.

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

- Plant species factor
- Irrigation efficiency
- Use of captured rainwater
- Use of recycled wastewater
- Use of water treated and conveyed by a public agency specifically for non-potable uses

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 1.2: Water Efficient Landscaping: No Potable Water Use or No Irrigation
1 Point in addition to WE Credit 1.1

Intent

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

Achieve WE Credit 1.1.and:

Use only captured rainwater, recycled wastewater, recycled greywater, or water treated and conveyed by a public agency specifically for non-potable uses for irrigation.

OR

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

Potential Technologies & Strategies

Perform a soil/climate analysis to determine appropriate landscape types and design the landscape with indigenous plants to reduce or eliminate irrigation requirements. Consider using stormwater, greywater, and/or condensate water for irrigation.

WE Credit 2: Innovative Wastewater Technologies
1 Point

Intent

Reduce generation of wastewater and potable water demand, while increasing the local aquifer recharge.

Requirements

OPTION 1

Reduce potable water use for building sewage conveyance by 50% through the use of water-conserving fixtures (water closets, urinals) or non-potable water (captured rainwater, recycled greywater, and on-site or municipally treated wastewater).

OR

OPTION 2

Treat 50% of wastewater on-site to tertiary standards. Treated water must be infiltrated or used on-site.

Potential Technologies & Strategies

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

WE Credit 3.1: Water Use Reduction: 20% Reduction
1 Point

Intent

Maximize 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) after meeting the Energy Policy Act of 1992 fixture performance requirements. Calculations are based on estimated occupant usage and shall include only the following fixtures (as applicable to the building): water closets, urinals, lavatory faucets, showers and kitchen sinks.

Potential Technologies & Strategies

Use high-efficiency fixtures, dry fixtures such as composting toilet systems and non-water using urinals, and occupant sensors to reduce the potable water demand. Consider reuse of stormwater and greywater for non-potable applications such as toilet and urinal flushing and custodial uses.

WE Credit 3.2: Water Use Reduction: 30% or 40% Reduction
1–2 Points in addition to WE Credit 3.1

Intent

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

Requirements

Employ strategies that in aggregate use 30% (1 point) or 40% (2 points) less water than the water use baseline calculated for the building (not including irrigation) after meeting the Energy Policy Act of 1992 fixture performance requirements. Calculations are based on estimated occupant usage and shall include only the following fixtures (as applicable to the building): water closets, urinals, lavatory faucets, showers and kitchen sinks.

Potential Technologies & Strategies

Use high-efficiency fixtures, dry fixtures such as composting toilet systems and non-water using urinals, and occupant sensors to reduce the potable water demand. Consider reuse of stormwater and greywater for non-potable applications such as toilet and urinal flushing, mechanical systems and custodial uses.

WE Credit 4: Process Water Use Reduction
1 Point

Intent

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

Requirements

To receive this credit, buildings must have:

- No refrigeration equipment using once-through cooling with potable water, AND
- No garbage disposals, AND
- At least 4 process items where water use is at or below the levels shown in the table below. For equipment not addressed by the table, additional equipment performance requirements may be proposed provided documentation supporting at least a 20% reduction over the proposed benchmark or industry standard is submitted.

Commercial Equipment Performance Requirements Table

Equipment Type	Maximum Water Use	Other Requirements
Clothes Washers[4]	7.5 gallons/ft^3/cycle	
Dishwashers with racks	1.0 gallons/rack	
Ice Machines[5]	Lbs/day>175	No water-cooled machines
	20 gallons/100lbs	
	Lbs/day<175	No water-cooled machines
	30 gallons/100/lbs	
Food Steamers	2 gallons/hour	Boilerless steamers only
Pre-Rinse Spray Valves	1.4 gallons per minute	

Potential Technologies & Strategies

Assess the process water equipment needs for the project, based on programmatic considerations and size of the school. Specify the use of high-efficiency equipment, appropriately sized, to reduce the potable water demand.

[4] Commercial CEE Tier 3a – Residential CEE Tier 1
[5] CEE Tier 3

Energy & Atmosphere

EA Prerequisite 1: Fundamental Commissioning of the Building Energy Systems
Required

Intent

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

Benefits of Commissioning

Benefits of commissioning include reduced energy use, lower operating costs, reduced 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 shall be completed by the commissioning team, in accordance with the LEED-NC 2.2 Reference Guide.

1) Designate an individual as the Commissioning Authority (CxA) to lead, review and oversee the completion of the commissioning process activities.
    a) The CxA shall have documented commissioning authority experience in at least two building projects.
    b) The individual serving as the CxA shall be independent of the project's design and construction management, though they may be employees of the firms providing those services. The CxA may be a qualified employee or consultant of the Owner.
    c) The CxA shall report results, findings and recommendations directly to the Owner.
    d) For projects smaller than 50,000 gross square feet, the CxA may include qualified persons on the design or construction teams who have the required experience.
2) The Owner shall document the Owner's Project Requirements (OPR). The design team shall develop the Basis of Design (BOD). The CxA shall review these documents for clarity and completeness. The Owner and design team shall be responsible for updates to their respective documents.
3) Develop and incorporate commissioning requirements into the construction documents.
4) Develop and implement a commissioning plan.
5) Verify the installation and performance of the systems to be commissioned.
6) Complete a summary commissioning report.

Commissioned Systems

Commissioning process activities shall 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 (wind, solar etc.)

Potential Technologies & Strategies

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 which impacts energy consumption, occupant comfort and indoor air quality. While it is not required to be commissioned by LEED, an owner can receive significant financial savings and reduced risk of poor indoor air quality by including building envelope commissioning.

The LEED-NC 2.2 Reference Guide 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

Establish the minimum level of energy efficiency for the proposed building and systems.

Requirements

Design the building project to comply with both—

- the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) of ASHRAE/IESNA Standard 90.1-2004 (without amendments); and
- the prescriptive requirements (Sections 5.5, 6.5, 7.5 and 9.5) or performance requirements (Section 11) of ASHRAE/IESNA Standard 90.1-2004 (without amendments).

Finally, the project must establish an Energy Performance Rating goal for the facility design using EPA's Target Finder rating tool.

Potential Technologies & Strategies

Design the building envelope, HVAC, lighting, and other systems to maximize energy performance. The ASHRAE 90.1-2004 User's Manual contains worksheets that can be used to document compliance with this prerequisite. For projects pursuing points under EA Credit 1, the computer simulation model may be used to confirm satisfaction of this prerequisite.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy standard process for commercial energy code determination, then it may be used to satisfy this prerequisite in lieu of ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found at www.energycodes.gov/implement/determinations_com.stm.

EA Prerequisite 3: Fundamental Refrigerant Management Required

Intent

Reduce ozone depletion.

Requirements

Zero use of CFC-based refrigerants in new base building 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 refrigerants and provide a replacement schedule for these refrigerants. For new buildings, specify new HVAC equipment in the base building that uses no CFC refrigerants.

EA Credit 1: Optimize Energy Performance

1–10 Points (2 mandatory)

Intent

Achieve increasing levels of energy performance above the baseline in the prerequisite standard to reduce environmental and economic impacts associated with excessive energy use.

Requirements

Demonstrate a percentage improvement in the proposed building performance rating compared to the baseline building performance rating per ASHRAE/IESNA Standard 90.1-2004 (without amendments) by a whole building project simulation using the Building Performance Rating Method in Appendix G of the Standard. The minimum energy cost savings percentage for each point threshold is as follows:

New Buildings	Building Renovations	Points
14%	7%	2 (mandatory)
17.5%	10.5%	3
21%	14%	4
24.5%	17.5%	5
28%	21%	6
31.5%	24.5%	7
35%	28%	8
38.5%	31.5%	9
42%	35%	10

Appendix G of Standard 90.1-2004 requires that the energy analysis done for the Building Performance Rating Method include ALL of the energy costs within and associated with the building project. To achieve points using this credit, the proposed design—

- must comply with the mandatory provisions (Sections 5.4, 6.4, 7.4, 8.4, 9.4 and 10.4) in Standard 90.1-2004 (without amendments);
- must include all the energy costs within and associated with the building project; and
- must be compared against a baseline building that complies with Appendix G to Standard 90.1-2004 (without amendments). The default process energy cost is 25% of the total energy cost for the baseline building. For buildings where the process energy cost is less than 25% of the baseline building energy cost, the LEED submittal must include supporting 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 (such as for the interior, parking garage, surface parking,

façade, or building grounds, except as noted above), HVAC (such as 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 EA Credit 1, process loads shall be identical for both the baseline building performance rating and for the proposed building performance rating. However, project teams may follow the Exceptional Calculation Method (ASHRAE 90.1-2004 G2.5) to document measures that reduce process loads. Documentation of process load energy savings shall include a list of the assumptions made for both the base and proposed design, and theoretical or empirical information supporting these assumptions.

OR

OPTION 2- PRESCRIPTIVE COMPLIANCE PATH (1 Point)*

Comply with the Basic Criteria and Prescriptive Measures of the Advanced Buildings Benchmark™ Version 1.1 with the exception of the following sections: 1.7 Monitoring and Trend-logging, 1.11 Indoor Air Quality, and 1.14 Networked Computer Monitor Control. Project teams must fully comply with all applicable criteria as established in Advanced Buildings Benchmark for the climate zone in which the building is located.

**Please note that Option 2 does not currently provide enough points to meet the mandatory minimum for new construction projects.*

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 as compared to a baseline building.

If a local code has demonstrated quantitative and textual equivalence following, at a minimum, the U.S. Department of Energy standard process for commercial energy code determination, then the results of that analysis may be used to correlate local code performance with ASHRAE 90.1-2004. Details on the DOE process for commercial energy code determination can be found at www.energycodes.gov/implement/determinations_com.stm.

EA Credit 2: On-Site Renewable Energy
1–3 Points

Intent

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

Requirements

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

Use the building annual energy cost calculated in EA Credit 1 or use the Department of Energy (DOE) Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use. (Table of use for different building types is provided in the Reference Guide.)

% Renewable Energy	Points
2.5%	1
7.5%	2
12.5%	3

Potential Technologies & Strategies

Assess the project for non-polluting 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.

Schools should contact their local utilities and state energy offices to identify potential financial incentives that can pay for some or all of the renewable energy system. In addition, some companies offer design, construction, maintenance, and financing of renewable energy systems if the school buys all the energy output of the system for a set fee and time period.

EA Credit 3: Enhanced Commissioning
1 Point

Intent

Begin the commissioning process early during 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 and in accordance with the LEED-NC 2.2 Reference Guide:

1. 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 shall, at a minimum, perform Tasks 2, 3 and 6. Other team members may perform Tasks 4 and 5.
    a. The CxA shall have documented commissioning authority experience in at least two building projects.
    b. The individual serving as the CxA shall be—
        i. independent of the work of design and construction;
        ii. not an employee of the design firm, though they may be contracted through them;
        iii. not an employee of, or contracted through, a contractor or construction manager holding construction contracts; and
        iv. (can be) a qualified employee or consultant of the Owner.
    c. The CxA shall report results, findings and recommendations directly to the Owner.
    d. This requirement has no deviation for project size.
2. The CxA shall conduct, at a minimum, one commissioning design review of the Owner's Project Requirements (OPR), Basis of Design (BOD), and design documents prior to mid-construction documents phase and back-check the review comments in the subsequent design submission.
3. The CxA shall review contractor submittals applicable to systems being commissioned for compliance with the OPR and BOD. This review shall be concurrent with A/E reviews and submitted to the design team and the Owner.
4. Develop a systems manual that provides future operating staff the information needed to understand and optimally operate the commissioned systems.
5. Verify that the requirements for training operating personnel and building occupants are completed.

6. Assure the involvement by the CxA in reviewing building operation within 10 months after substantial completion with O&M staff and occupants. Include a plan for resolution of outstanding commissioning-related issues.

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-NC 2.2 Reference Guide provides detailed guidance on the rigor expected for following process activities:

- Commissioning design review
- Commissioning submittal review
- Systems manual

EA Credit 4: Enhanced Refrigerant Management
1 Point

Intent

Reduce ozone depletion and support early compliance with the Montreal Protocol while minimizing direct contributions to global warming.

Requirements

OPTION 1

Do not use refrigerants.

OR

OPTION 2

Select refrigerants and HVAC&R that minimize or eliminate the emission of compounds that contribute to ozone depletion and global warming. The base building HVAC&R equipment shall comply with the following formula, which sets a maximum threshold for the combined contributions to ozone depletion and global warming potential:

$$LCGWP + LCODP \times 10^5 \leq 100$$

Where:

$LCODP = [ODP_r \times (Lr \times Life + Mr) \times Rc]/Life$
$LCGWP = [GWPr \times (Lr \times Life + Mr) \times Rc]/Life$
LCODP: Lifecycle Ozone Depletion Potential (lbCFC11/Ton-Year)
LCGWP: Lifecycle Direct Global Warming Potential ($lbCO_2$/Ton-Year)
GWPr: Global Warming Potential of Refrigerant (0 to 12,000 $lbCO_2$/lbr)
ODPr: Ozone Depletion Potential of Refrigerant (0 to 0.2 lbCFC11/lbr)
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)
Rc: Refrigerant Charge (0.5 to 5.0 lbs of refrigerant per ton of cooling capacity)
Life: Equipment Life (10 years; default based on equipment type, unless otherwise demonstrated)

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

$$[\sum (LCGWP + LCODP \times 10^5) \times Qunit\ ] / Qtotal \leq 100$$

Where:

Qunit = Cooling capacity of an individual HVAC or refrigeration unit (Tons)
Qtotal = Total cooling capacity of all HVAC or refrigeration

Small HVAC units (defined as containing less than 0.5 lbs of refrigerant), and other equipment such as standard refrigerators, small water coolers, and any other cooling equipment that contains

less than 0.5 lbs of refrigerant, are not considered part of the "base building" system and are not subject to the requirements of this credit.

AND

Do not install fire suppression systems that contain ozone-depleting substances (CFCs, 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 and refrigeration systems for the refrigeration cycle that minimize direct impact on ozone depletion and global warming. Select HVAC&R equipment with reduced refrigerant charge and increased equipment life. Maintain equipment to prevent leakage of refrigerant to the atmosphere. Utilize fire suppression systems that do not contain HCFCs or Halons.

EA Credit 5: Measurement & Verification
1 Point

Intent

Provide for the ongoing accountability of building energy consumption over time.

Requirements

- Develop and implement a Measurement & Verification (M&V) Plan consistent with Option D: Calibrated Simulation (Savings Estimation Method 2), or 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 shall cover a period of no less than one year of post-construction occupancy.

- Provide a process for corrective action to ensure energy savings are realized 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. M&V 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 that equipment is not being optimally operated. 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 24/7.
- Equipment operation during unusual circumstances (e.g., boiler on when outside air temperature above 65°F)

Besides control diagnostics, consider employing retro-commissioning services or dedicating staff to investigate increases in energy usage (such a staff member is usually a resource conservation manager– see http://www.energy.state.or.us/rcm/rcmhm.htm for additional information).

EA Credit 6: Green Power
1 Point

Intent

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

Requirements

Provide at least 35% of the building's electricity from renewable sources by engaging in at least a two-year renewable energy contract. Renewable sources are as defined by the Center for Resource Solutions (CRS) Green-e products certification requirements.

DETERMINE THE BASELINE ELECTRICITY USE

Use the annual electricity consumption from the results of EA Credit 1.

OR

Use the Department of Energy (DOE) Commercial Buildings Energy Consumption Survey (CBECS) database to determine the estimated electricity use.

School districts can purchase green power on a centralized basis and allocate the green power to a specific project.

Potential Technologies & Strategies

Determine the energy needs of the building and investigate opportunities to engage in a green power contract. Green power is derived from solar, wind, geothermal, biomass or low-impact hydro sources. Visit www.green-e.org for details about the Green-e program. The power product purchased to comply with credit requirements need not be Green-e certified. Other sources of green power are eligible if they satisfy the Green-e program's technical requirements. Renewable energy certificates (RECs), tradable renewable certificates (TRCs), green tags and other forms of green power that comply with Green-e's technical requirements can be used to document compliance with EA Credit 6 requirements.

Materials & Resources

MR Prerequisite 1: Storage & Collection of Recyclables Required

Intent

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

Requirements

Provide an easily accessible area that serves the entire building and is dedicated to the collection and storage of non-hazardous materials for recycling, including (at a minimum) paper, corrugated cardboard, glass, plastics and metals. An area should also be dedicated to collection and storage of plant-based landscaping debris (trimmings), unless the site has no landscaping.

Potential Technologies & Strategies

Coordinate the size and functionality of the recycling areas with the anticipated collection services for glass, plastic, office paper, newspaper, cardboard and organic wastes to maximize the effectiveness of the dedicated areas. Consider employing cardboard balers, aluminum can crushers, recycling chutes and collection bins at individual workstations to further enhance the recycling program.

MR Credit 1.1: Building Reuse: Maintain 75% of Existing Walls, Floors & Roof
1 Point

Intent

Extend the life cycle 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 at least 75% (based on surface area) of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material). Hazardous materials that are remediated as a part of the project scope shall be excluded from the calculation of the percentage maintained. If the project includes an addition to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies

Consider reuse of existing, previously occupied buildings, including structure, envelope and elements. Remove elements that pose 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 95% of Existing Walls, Floors & Roof
1 Point in addition to MR Credit 1.1

Intent

Extend the life cycle 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 an additional 20% (95% total, based on surface area) of existing building structure (including structural floor and roof decking) and envelope (exterior skin and framing, excluding window assemblies and non-structural roofing material). Hazardous materials that are re-mediated as a part of the project scope shall be excluded from the calculation of the percentage maintained. If the project includes an addition to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies

Consider reuse of existing buildings, including structure, envelope and elements. Remove elements that pose 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 1.3: Building Reuse: Maintain 50% of Interior Non-Structural Elements

1 Point

Intent

Extend the life cycle 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 non-structural elements (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 to an existing building, this credit is not applicable if the square footage of the addition is more than 2 times the square footage of the existing building.

Potential Technologies & Strategies

Consider reuse of existing buildings, including structure, envelope and interior non-structural elements. Remove elements that pose 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: Divert From Disposal
1–2 Points

Intent

Divert construction, demolition and land-clearing debris from disposal in landfills and incinerators. Redirect recyclable recovered resources back to the manufacturing process. Redirect reusable materials to appropriate sites.

Requirements

Recycle and/or salvage at least:

- 50% (1 point)
- 75% (2 points)

of non-hazardous 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 co-mingled. 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.

Potential Technologies & Strategies

Establish goals for diversion from disposal in landfills and incinerators and adopt a construction waste management plan to achieve these goals. Consider recycling cardboard, metal, brick, acoustical tile, concrete, plastic, clean wood, glass, gypsum wallboard, carpet and insulation. 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

Reuse building materials and products in order to reduce demand for virgin materials and to reduce waste, thereby reducing impacts associated with the extraction and processing of virgin resources.

Requirements

Use salvaged, refurbished or reused materials such that the sum of these materials constitutes at least:

- 5%, (1 point)
- 10% (2 points)

based on cost, of the total value of materials on the project.

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

Potential Technologies & Strategies

Identify opportunities to incorporate salvaged materials into 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: (post-consumer + 1/2 pre-consumer)
1-2 Points

Intent

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 such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes at least:

- 10% (1 point)
- 20% (2 points)

(based on cost) of the total value of the materials in the project.

The recycled content value of a material assembly shall be 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 shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

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

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

Pre-consumer material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.

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.

MR Credit 5: Regional Materials: Extracted, Processed & Manufactured Regionally
1–2 Points

Intent

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 500 miles of the project site for a minimum of:

- 10% (based on cost) of the total materials value (1 point).
- 20% (based on cost of the total materials value (1 point).

If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.

Mechanical, electrical and plumbing components and specialty items such as elevators and equipment shall not be included in this calculation. Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

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

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

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

Encourage environmentally responsible forest management.

Requirements

Use a minimum of 50% of wood-based materials and products, which are certified in accordance with the Forest Stewardship Council's (FSC) Principles and Criteria, for wood building components. These components include, but are not limited to, structural framing and general dimensional framing, flooring, sub-flooring, wood doors and finishes.

Only include materials permanently installed in the project. Furniture may be included, providing it is included consistently in MR Credits 3–7.

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

EQ Prerequisite 1: Minimum IAQ Performance

Required

Intent

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 62.1-2004, Ventilation for Acceptable Indoor Air Quality. Mechanical ventilation systems shall be designed using the Ventilation Rate Procedure or the applicable local code, whichever is more stringent.

Naturally ventilated buildings shall comply with ASHRAE 62.1-2004, paragraph 5.1.

Potential Technologies & Strategies

Design ventilation systems to meet or exceed the minimum outdoor air ventilation rates as described in the ASHRAE standard. Balance the impacts of ventilation rates on energy use and indoor air quality to optimize for energy efficiency and occupant health. Use the ASHRAE 62 Users Manual for detailed guidance on meeting the referenced requirements.

EQ Prerequisite 2: Environmental Tobacco Smoke (ETS) Control Required

Intent

Eliminate exposure of building occupants, indoor surfaces, and ventilation air distribution systems to Environmental Tobacco Smoke (ETS).

Requirements

Prohibit smoking in the building and locate any exterior designated smoking areas at least 25 feet away from entries, outdoor air intakes and operable windows.

Potential Technologies & Strategies

Prohibit smoking in schools.

EQ Prerequisite 3: Minimum Acoustical Performance Required

Intent

Provide classrooms that are quiet and in which teachers can speak to the class without straining their voices and students can effectively communicate with each other and the teacher.

Requirements

Design classrooms and other core learning spaces to meet the Reverberation Time (RT) requirements of ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools. Also design classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements, excepting windows which must meet an STC rating of at least 35.

AND EITHER

OPTION 1
Using the methodology described annexes B through D in Standard S12.60-2002, achieve a maximum background noise level in classrooms and other primary learning spaces of 45 dBA.

OPTION 2
Design classrooms and other core learning spaces using the methodology listed in the 2003 HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control, and achieve an RC (N) Mark II level of 37.

Potential Technologies & Strategies

Design considerations include reducing noise from exterior to interior spaces, between spaces within the building, and within the classroom space. External to internal noise transmission can be reduced by orienting classrooms away from external noise sources and using thick and/or massive materials in walls and roofs. Also, windows should be well sealed and have adequate air gaps between sheets of glass.

To reduce noise transmission between spaces within the building several options are available and include: the type of material and construction method, eliminating wall gaps, tight fitting doors, staggering doors across hallways, and isolating HVAC noise. Isolating HVAC noise is probably the critical element to be considered in the design phase. Isolating HVAC noise depends on the type of mechanical equipment chosen and its location.

Simple ducting of the supply-air path, and to a lesser extent, the return-air path, will provide significant value in meeting the background noise criteria. Operable partitions should be considered only where it is the program intent that they be occasionally closed, versus occasionally open.

To reduce noise within the classroom, add sound absorbing materials such as fabric-faced wall panels, carpet, and/or acoustical ceiling tiles. Lower classroom noise levels can be achieved by avoiding installation of fans, compressors, and other HVAC machinery in the classroom. Electronic amplification or sound masking do not contribute towards this prerequisite. See the Reference Guide for more information on which spaces are applicable for this point.

EQ Credit 1: Outdoor Air Delivery Monitoring
1 Point

Intent

Provide capacity for ventilation system monitoring to help sustain occupant comfort and well-being.

Requirements

Install permanent monitoring systems that provide feedback on ventilation system performance to ensure that ventilation systems maintain design minimum ventilation requirements. Configure all monitoring equipment to generate an alarm when the conditions vary by 10% or more from setpoint, via either a building automation system alarm to the building operator or via a visual or audible alert to the building occupants.

FOR MECHANICALLY VENTILATED SPACES

- Monitor carbon dioxide concentrations within all densely occupied spaces (those with a design occupant density greater than or equal to 25 people per 1000 sq.ft.). CO_2 monitoring locations shall be between 3 feet and 6 feet above the floor.
- For each mechanical ventilation system serving non-densely occupied spaces, provide a direct outdoor airflow measurement device capable of measuring the minimum outdoor airflow rate with an accuracy of plus or minus 15% of the design minimum outdoor air rate, as defined by ASHRAE 62.1-2004.

FOR NATURALLY VENTILATED SPACES

Monitor CO_2 concentrations within all naturally ventilated spaces. CO_2 monitoring shall be located within the room between 3 feet and 6 feet above the floor. One CO_2 sensor may be used to represent multiple 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 carbon dioxide and airflow measurement equipment and feed the information to the 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.

EQ Credit 2: Increased Ventilation
1 Point

Intent

Provide additional outdoor air ventilation to improve indoor air quality for improved occupant comfort, well-being and productivity.

Requirements

FOR MECHANICALLY VENTILATED SPACES

- Increase breathing zone outdoor air ventilation rates to all occupied spaces by at least 30% above the minimum rates required by ASHRAE Standard 62.1-2004 as determined by EQ Prerequisite 1.

FOR NATURALLY VENTILATED SPACES

Design natural ventilation systems for occupied spaces to meet the recommendations set forth in the Carbon Trust "Good Practice Guide 237" [1998]. Determine that natural ventilation is an effective strategy for the project by following the flow diagram process shown in Figure 1.18 of the Chartered Institution of Building Services Engineers (CIBSE) Applications Manual 10: 2005, Natural ventilation in non-domestic buildings.

AND

- Use diagrams and calculations to show that the design of the natural ventilation systems meets the recommendations set forth in the CIBSE Applications Manual 10: 2005, Natural ventilation in non-domestic buildings.

OR

- Use a macroscopic, multi-zone, analytic model to predict that room-by-room airflows will effectively naturally ventilate, defined as providing the minimum ventilation rates required by ASHRAE 62.1-2004 Chapter 6, for at least 90% of occupied spaces.

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 eight design steps described in the Carbon Trust Good Practice Guide 237 – 1) Develop design requirements, 2) Plan airflow paths, 3) Identify building uses and features that might require special attention, 4) Determine ventilation requirements, 5) Estimate external driving pressures, 6) Select types of ventilation devices, 7) Size ventilation devices, 8) 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.

EQ Credit 3.1: Construction IAQ Management Plan: During Construction
1 Point

Intent

Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Requirements

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the construction and pre-occupancy 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, 1995, Chapter 3.
- Protect stored on-site or 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 shall be used at each return air grille, as determined by ASHRAE 52.2-1999. Replace all filtration media immediately prior to occupancy.
- Prohibit smoking inside the building and within 25 feet of building entrances once the building is enclosed.

Potential Technologies & Strategies

Adopt an IAQ management plan to protect the 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 Indoor Environmental Quality Credits 3.2 and 5 to determine the appropriate specifications and schedules for filtration media.

It is highly recommended to avoid using permanently installed air handlers for temporary heating/cooling during construction. Consult the LEED-NC v2.2 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.

EQ Credit 3.2: Construction IAQ Management Plan: Before Occupancy

1 Point

Intent

Reduce indoor air quality problems resulting from the construction/renovation process in order to help sustain the comfort and well-being of construction workers and building occupants.

Requirements

Develop and implement an Indoor Air Quality (IAQ) Management Plan for the pre-occupancy phase as follows:

OPTION 1 — Flush-Out

- After construction ends, prior to occupancy and with all interior finishes installed, perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%.

  OR

- If occupancy is desired prior to completion of the flush-out, the space may be occupied following delivery of a minimum of 3,500 cu.ft. of outdoor air per sq.ft. of floor area to the space. Once a space is occupied, it shall be ventilated at a minimum rate of 0.30 cfm/sq.ft. of outside air or the design minimum outside air rate determined in EQ Prerequisite 1, whichever is greater. During each day of the flush-out period, ventilation shall begin a minimum of three hours prior to occupancy and continue during occupancy. These conditions shall be maintained until a total of 14,000 cu.ft./sq.ft. 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 United States Environmental Protection Agency Compendium of Methods for the Determination of Air Pollutants in Indoor Air and as additionally detailed in the Reference Guide.
- Demonstrate that the contaminant maximum concentrations listed below are not exceeded.

CONTAMINANT	MAXIMUM CONCENTRATION
Formaldehyde	50 parts per billion
Particulates (PM10)	50 micrograms per cubic meter
Total Volatile Organic Compounds (TVOC)	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 material are installed as part of the building systems.

- For each sampling point where the maximum concentration limits are exceeded conduct additional flush-out with outside air and retest the specific parameter(s) exceeded to indicate the requirements are achieved. Repeat procedure until all requirements have been met. When retesting non-complying building areas, take samples from the same locations as in the first test.
- The air sample testing shall be conducted as follows:
    1) All measurements shall be conducted prior to occupancy, but during normal occupied hours, and with the building ventilation system starting at the normal daily start time and operated at the minimum outside air flow rate for the occupied mode throughout the duration of the air testing.
    2) The building shall have all interior finishes installed, including but not limited to millwork, doors, paint, carpet and acoustic tiles. Non-fixed furnishings such as workstations and partitions are encouraged, but not required, to be in place for the testing.
    3) The number of sampling locations will vary depending upon 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 shall not be less than one per 25,000 sq.ft., or for each contiguous floor area, whichever is larger, and include areas with the least ventilation and greatest presumed source strength.
    4) Air samples shall be collected between 3 feet and 6 feet 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 Indoor Environmental Quality Credits 3.1 and 5 to determine the appropriate specifications and schedules for filtration media.

EQ Credit 4: Low-Emitting Materials
1-4 Points

Intent

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

Projects may choose any of the following options, with a maximum of 4 points.

OPTION 1: ADHESIVES & SEALANTS (1 point)

All adhesives and sealants installed in the building interior (defined as inside of the weatherproofing system and applied on-site) shall meet the testing and product requirements of the California Department of Health Services *Standard Practice for The Testing Of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers,* including 2004 Addenda.

OPTION 2: PAINTS & COATINGS (1 point)

All paints and coatings installed in the building interior shall meet the testing and product requirements of the California Department of Health Services *Standard Practice for The Testing Of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers,* including 2004 Addenda.

OPTION 3: FLOORING SYSTEMS (1 point)

All flooring elements installed in the building interior shall meet the testing and product requirements of the California Department of Health Services *Standard Practice for The Testing Of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers,* including 2004 Addenda.

OPTION 4: COMPOSITE WOOD & AGRIFIBER PRODUCTS (1 point)

All composite wood and agrifiber products installed in the building interior shall meet the testing and product requirements of the California Department of Health Services *Standard Practice for The Testing Of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers,* including 2004 Addenda.

OPTION 5: FURNITURE & FURNISHINGS (1 point)

Classroom furniture including all student and teacher desks, tables and seats introduced into the project space that has been manufactured, refurbished or refinished within one year prior to occupancy must meet one of the requirements below. Salvaged and used furniture that is more than one year old at the time of occupancy is excluded from the credit requirements.

Method A: GREENGUARD Children & Schools Certified

OR

Method B: Calculated indoor air concentrations that are less than or equal to those established in Table 1 for furniture systems and seating determined by a procedure based on the U.S. Environmental Protection Agency's Environmental Technology Verification (ETV) Large Chamber Test Protocol for Measuring Emissions of VOCs and Aldehydes (September 1999) testing protocol conducted in an independent air quality testing laboratory.

Table 1. Indoor Air Concentrations

Chemical Contaminant	Emission Limits Classroom Furniture	Emission Limits Seating
TVOC	0.5 mg/m^3	0.25 mg/m^3
Formaldehyde	50 parts per billion	25 parts per billion
Total Aldehydes	100 parts per billion	50 parts per billion
4 – Phenylcyclohexene (4-PCH)	0.0065 mg/m^3	0.00325 mg/m^3

OR

Method C: Calculated indoor air concentrations that are less than or equal to those established in Table 1 for furniture systems and seating determined by a procedure based on BIFMA M7.1-2005 and X7.1-2005 testing protocol conducted in an independent third party air quality testing laboratory.

OPTION 6: CEILING AND WALL SYSTEMS (1 point)

All gypsum board, insulation, acoustical ceiling systems and wall coverings installed in the building interior shall meet the testing and product requirements of the California Department of Health Services *Standard Practice for The Testing Of Volatile Organic Emissions From Various Sources Using Small-Scale Environmental Chambers,* including 2004 Addenda.

Potential Technologies & Strategies

Clearly specify requirements for product testing and/or certification in the construction documents. Some programs that offer verification of the cited standard for Options 1-4 and 6 are Indoor Advantage Gold, GREENGUARD Children & Schools, the Resilient Floor Covering Institute's FloorScore program, the Carpet and Rug Institute's Green Label Plus program, and the Collaborative for High Performance Schools product list. Indoor Advantage Gold offers verification of the BIFMA standard cited in Option C of the Furniture Option.

EQ Credit 5: Indoor Chemical & Pollutant Source Control
1 Point

Intent

Minimize exposure of building occupants to potentially hazardous particulates and chemical pollutants.

Requirements

Design to minimize and control pollutant entry into buildings and later cross-contamination of regularly occupied areas:

- Employ permanent entryway systems at least six feet long in the primary direction of travel to capture dirt and particulates from entering the building at all entryways that are directly connected to the outdoors. Acceptable entryway systems include permanently installed grates, grilles, or slotted systems that allow for cleaning underneath. Roll-out mats are only acceptable when maintained on a weekly basis by a contracted service organization or school maintenance staff. Qualifying entryways are those that serve as regular entry points for building users.
- Where hazardous gases or chemicals may be present or used (including garages, housekeeping/laundry areas, science laboratories, prep rooms, art rooms, shops of any kind, and copying/printing rooms), exhaust each space sufficiently to create negative pressure with respect to adjacent spaces with the doors to the room closed. For each of these spaces, provide self-closing doors and deck to deck partitions or a hard lid ceiling. The exhaust rate shall be at least 0.50 cfm/sq.ft., with no air re-circulation. The pressure differential with the surrounding spaces shall be at least 5 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.
- In mechanically ventilated buildings, provide regularly occupied areas of the building with air filtration media prior to occupancy that provides a Minimum Efficiency Reporting Value (MERV) of 13 or better. Filtration should be applied to process both return and outside air that is to be delivered as supply air.
- Provide containment drains plumbed for appropriate disposal of hazardous liquid wastes in places where water and chemical concentrate mixing occurs for laboratory purposes.

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 both return air and outside supply air. Ensure that air handling units can accommodate required filter sizes and pressure drops.

EQ Credit 6.1: Lighting System Design and Controllability
1 Point

Intent

Provide a high level of lighting system control by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

Requirements

FOR ADMINISTRATIVE OFFICES AND OTHER REGULARLY OCCUPIED SPACES:

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

AND

FOR CLASSROOMS AND CORE LEARNING SPACES, with the exception of chemistry laboratories, art rooms, shops, music rooms, and dance/exercise studios,

Provide a classroom lighting system that operates in two modes: general illumination and A/V.

- In general illumination mode, achieve an average illumination at the desk level of 35 to 50 footcandles with a minimum of 25 footcandles at any point more than 3 ft from any wall.
- In A/V mode, not including contribution from the teaching wall light, achieve an average illumination at the desk level of between 10 and 20 footcandles for any point in the room greater than 3 ft from the side walls, 10 ft from the front wall and 6 ft from the back wall, while limiting vertical illumination on the projection screen to no more than 7 footcandles at any point on the screen.

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.

EQ Credit 6.2: Thermal Comfort Controllability
1 Point

Intent

Provide a high level of thermal comfort system control by individual occupants or by specific groups in multi-occupant spaces (i.e. classrooms or conference areas) to promote the productivity, comfort and well-being of building occupants.

Requirements

Provide individual comfort controls for 50% (minimum) of the building occupants in workspaces to enable adjustments to suit individual task needs and preferences. Operable windows can be used in lieu of comfort controls for occupants of areas that are 20 feet inside of and 10 feet to either side of the operable part of the window. The areas of operable window must meet the requirements of ASHRAE 62.1-2004 paragraph 5.1 Natural Ventilation.

AND

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

Conditions for thermal comfort are described in ASHRAE Standard 55-2004 to include the primary factors of air temperature, radiant temperature, air speed and humidity. Comfort system control for the purposes of this credit is defined as the provision of control over at least one of these primary factors in the occupant's local environment.

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. ASHRAE Standard 55-2004 identifies 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 to allow adjustments to suit individual needs and preferences. These 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, or control of individual radiant panels, or other means integrated into the overall building, thermal comfort systems, and energy systems design. In addition, designers should evaluate the closely tied interactions between thermal comfort (as required by ASHRAE Standard 55-2004) and acceptable indoor air quality (as required by ASHRAE Standard 62.1-2004, whether natural or mechanical ventilation).

EQ Credit 7.1: Thermal Comfort: Design
1 Point

Intent

Provide a comfortable thermal environment that supports the productivity and well-being of building occupants.

Requirements

Design HVAC systems and the building envelope to meet the requirements of ASHRAE Standard 55-2004, Thermal Environmental Conditions for Human Occupancy. Demonstrate design compliance in accordance with the Section 6.1.1 Documentation.

For natatoriums, demonstrate compliance with the "Typical Natatorium Design Conditions" defined in Chapter 4 (Places of Assembly) of the ASHRAE HVAC Applications Handbook, 2003 edition.

Potential Technologies & Strategies

Establish comfort criteria per ASHRAE Standard 55-2004 that support the desired quality and occupant satisfaction with building performance. In gymnasiums, if mechanical ventilation is not used, follow ASHRAE Standard 55-2004 requirements for naturally ventilated spaces. Design building envelope and systems with the capability to deliver performance to 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 EQ Prerequisite 1, EQ Credit 1, and EQ Credit 2.

EQ Credit 7.2: Thermal Comfort: Verification
1 Point

Intent

Provide for the assessment of building thermal comfort over time.

Requirements

Agree to implement a thermal comfort survey of building occupants (adults and students of grades 6 and above) within a period of six 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.

Potential Technologies & Strategies

ASHRAE Standard 55-2004 provides guidance for establishing thermal comfort criteria and the documentation and validation of 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 design of monitoring and corrective action systems.

EQ Credit 8.1: Daylight & Views: Daylighting

1–2 Points

Intent

Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the building.

Requirements

Through one of the three optional methodologies, achieve daylighting through one of the three options below in at least the following spaces:

- 75% of all classroom spaces (1 point), or
- 90% of all classroom spaces (2 points), or
- 75% of all other regularly occupied spaces (1 additional point). Project teams can only achieve a point for these other spaces if they have also achieved at least one point for classroom spaces.

OPTION 1 — CALCULATION

Achieve a minimum glazing factor of 2%. The glazing factor is calculated as follows:

$$\text{Glazing Factor} = \frac{\text{Window Area [SF]}}{\text{Floor Area [SF]}} \times \text{Window Geometry Factor} \times \frac{\text{Actual } T_{vis}}{\text{Minimum } T_{vis}} \times \text{Window Height Factor}$$

OPTION 2 — SIMULATION

Demonstrate, through computer simulation, that a minimum daylight illumination level of 25 footcandles has been achieved. Modeling must demonstrate 25 horizontal footcandles under clear sky conditions, at noon, on the equinox, at 30 inches above the floor.

OPTION 3 — MEASUREMENT

Demonstrate, through records of indoor light measurements, that a minimum daylight illumination level of 25 footcandles has been achieved. Measurements must be taken on a 10-foot grid for all occupied spaces and must be recorded on building floor plans.

In all cases, only the square footage associated with the portions of rooms or spaces meeting the minimum illumination requirements can be applied towards the calculation required to qualify for this credit.

In all cases, 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 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 automatic photocell-based controls. See the Reference Guide for more information on which spaces are applicable for this point.

EQ Credit 8.2: Daylight & Views: Views for 90% of Spaces
1 Point

Intent

Provide for the building occupants a connection between indoor spaces and the outdoors through the introduction of daylight and views into the building.

Requirements

Achieve direct line of sight to the outdoor environment via vision glazing between 2'6" and 7'6" above finish floor for building occupants in 90% of all regularly occupied areas. Determine the area with direct line of sight by totaling the regularly occupied square footage 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.

Line of sight may be drawn through interior glazing. For private offices, the entire square footage of the office can be counted if 75% or more of the area has direct line of sight to perimeter vision glazing. For classrooms and other multi-occupant spaces, the actual square footage with 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 partition heights, interior shading devices, interior glazing, and automatic photocell-based controls. See the Reference Guide for more information on which spaces are applicable for this point.

EQ Credit 9: Enhanced Acoustical Performance

1-2 Points

Intent

Provide classrooms that facilitate better teacher-to-student and student-to-student communications.

Requirements

Design classrooms and other core learning spaces to meet the Reverberation Time (RT) requirements of ANSI Standard S12.60-2002, Acoustical Performance Criteria, Design Requirements and Guidelines for Schools. Also design classrooms and other core learning spaces to meet the Sound Transmission Class (STC) requirements, excepting windows, which must meet an STC rating of at least 35.

AND

OPTION 1
Using the methodology described in Standard S12.60-2002, achieve a maximum unoccupied background noise level in classrooms and other primary learning spaces of:
40 dBA (1 Point)
35 dBA (2 Points)

OPTION 2
Design classrooms and other core learning spaces using the methodology listed in the 2003 HVAC Applications ASHRAE Handbook, Chapter 47 on Sound and Vibration Control, and achieve an RC (N) Mark II level of:
32 (1 Point)
27 (2 Points)

Potential Technologies & Strategies

Design considerations include reducing noise from exterior to interior spaces, between spaces within the building, and within the classroom space. External to internal noise transmission can be reduced by orienting classrooms away from external noise sources and using thick and/or massive materials in walls and roofs. Also, windows should be well sealed and have adequate air gaps between sheets of glass. See EQ Prerequisite 3 for more potential technologies and strategies.

EQ Credit 10: Mold Prevention

1 Point

Intent

Reduce the potential presence of mold in schools through preventive design and construction measures.

Requirements

Project teams must achieve the following credits:

1. EQ credit 3.1- Construction IAQ Management Plan: During Construction
2. EQ credit 7.1- Thermal Comfort: Compliance
3. EQ Credit 7.2 – Thermal Comfort: Verification

AND

Provide HVAC systems and controls designed to limit space relative humidity to 60% or less during all load conditions, both occupied and unoccupied.

AND

Develop and implement on an ongoing basis an IAQ management program for buildings based on the EPA document "Building Air Quality: A Guide for Building Owners and Facility Managers," EPA Reference Number 402-F-91-102, December 1991.

Potential Technologies & Strategies

A complete guide to preventing mold and reducing the probability of it recurring can be found in the EPA's Mold Remediation in Schools and Commercial Buildings document EPA 402-K-01-001. The Greenguard Environmental Institute offers its Greenguard Mold Protection Program™. The EPA Design Tools for Schools program offers a comprehensive program for preventing mold during the design and construction phases of your school project. These documents contain a comprehensive overview of the principles and practices stated here and serve as valuable resources in constructing commissioning plans and operation and maintenance guides.

Project teams should be aware of potential differences in construction if portable classrooms and modular classroom units are being used.

Innovation & Design Process

ID Credit 1-1.4: Innovation in Design
1-4 Points

Intent

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

Requirements

Credit 1.1 (1 point) In writing, identify the intent of the proposed innovation credit, the proposed requirement for compliance, the proposed submittals to demonstrate compliance, and the design approach (strategies) that might be used to meet the requirements.

Credit 1.2 (1 point) Same as Credit 1.1

Credit 1.3 (1 point) Same as Credit 1.1

Credit 1.4 (1 point) Same as Credit 1.1

Potential Technologies & Strategies

Substantially exceed a LEED-NC 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 1 Option: Exterior Acoustic Performance

An Exemplary Performance ID point will be available to project teams that achieve one or both points in EQc9 and achieving a maximum outdoor background noise level of 55 dBA for playgrounds, and 60 dBA for athletic fields and all other school grounds.

ID Credit 1 Option: Low Impact Cleaning and Maintenance Equipment Policy

1 Point

Intent

Reduce exposure of building occupants and maintenance personnel to potentially hazardous chemical, biological and particle contaminants

Requirements

Implement a policy for the use of janitorial equipment that maximizes effective reduction of building contaminants with minimum environmental impact. Cleaning equipment policy needs to specify that:

- Vacuum Cleaners meet Carpet &Rug Cleaners Green Label and are capable of capturing 96% of particulates 0.3 microns in size and operate with a sound level of less than 70 dBA
- Hot water extraction equipment for deep cleaning carpets are capable of removing sufficient moisture such that carpets can dry in less than 24 hours.
- Powered maintenance equipment including floor buffers, burnishers and automatic scrubbers is equipped with vacuums, guards, and/or other devices for capturing fine particulates, and shall operate with sound levels less than 70 dBA.
- Propane powered equipment has high-efficiency, low-emissions engines.
- Automated scrubbing machines are equipped with variable-speed feed pumps to optimize the use of cleaning fluids.
- Where appropriate, active micro fiber technology is used to reduce cleaning chemical consumption and prolong life of disposable scrubbing pads.
- Leaf blowers and lawn mowers with electrical power only and sound level less than 70 dBA.

Potential Technologies and Strategies

Develop, implement and maintain a policy for the use of janitorial equipment that maximizes effective reduction of building contaminants with minimum environmental impact. Evaluate the janitorial equipment currently being used at other schools and make a plan for upgrading to janitorial equipment that maximizes effective reduction of building contaminants with minimum environmental impact. Have in place at opening of school a policy with procurement guidelines defining the performance criteria outlined in this credit. When purchasing equipment, specify that they must meet the specified sustainability criteria.

This credit compliments a Green Housekeeping Innovation Credit as outlined in CIR from 4/8/04 "Environmentally Preferable Cleaning Products and Practices" for overall Green Upkeep of the new school building. It is best to have in place at opening of school a low-impact environmental cleaning products and housekeeping policy that addresses sustainable cleaning and hard flooring coating systems products and utilization of concentrated cleaning products. Floor products that are free of zinc are preferred.

ID Credit 2: LEED Accredited Professional

1 Point

Intent

To support and encourage the design integration required by a LEED-NC green building project and to streamline the application and certification process.

Requirements

At least one 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 & construction and application of the LEED Rating System early in the life of the project. Consider assigning the LEED AP as a facilitator of an integrated design & construction process.

ID Credit 3: The School as a Teaching Tool

1 Point

Intent

Integrate the sustainable features of a school facility with the school's educational mission.

Requirements

Design curriculum based on the high performance features of the building, and commit to implementing the curriculum within 10 months of LEED certification. The curriculum should not just describe the features themselves but explore the relationship between human ecology, natural ecology and the building ecology of the building. Curriculum must meet local or state curriculum standards, be approved by school administrators, and provide 10 or more hours of classroom instruction per year per full-time student.

Potential Technologies & Strategies

It is highly recommended that project teams coordinate closely with school administration and faculty where possible, to encourage ongoing relationships between high-performance features of the school and the students. Entirely new curricula need not be developed, it may be more cost-effective to revise existing curricula to incorporate new lessons.

For curriculum development, engage the school in a program that integrates the school building with the curriculum in the school. Consider the National Energy Education Development (NEED) Project, the Alliance to Save Energy's Green Schools Program, and National Energy Foundation educational resources. A collection of energy education resources can also be found at the Energy Information Agency's website at: www.eia.doe.gov/kids/onlineresources.html.