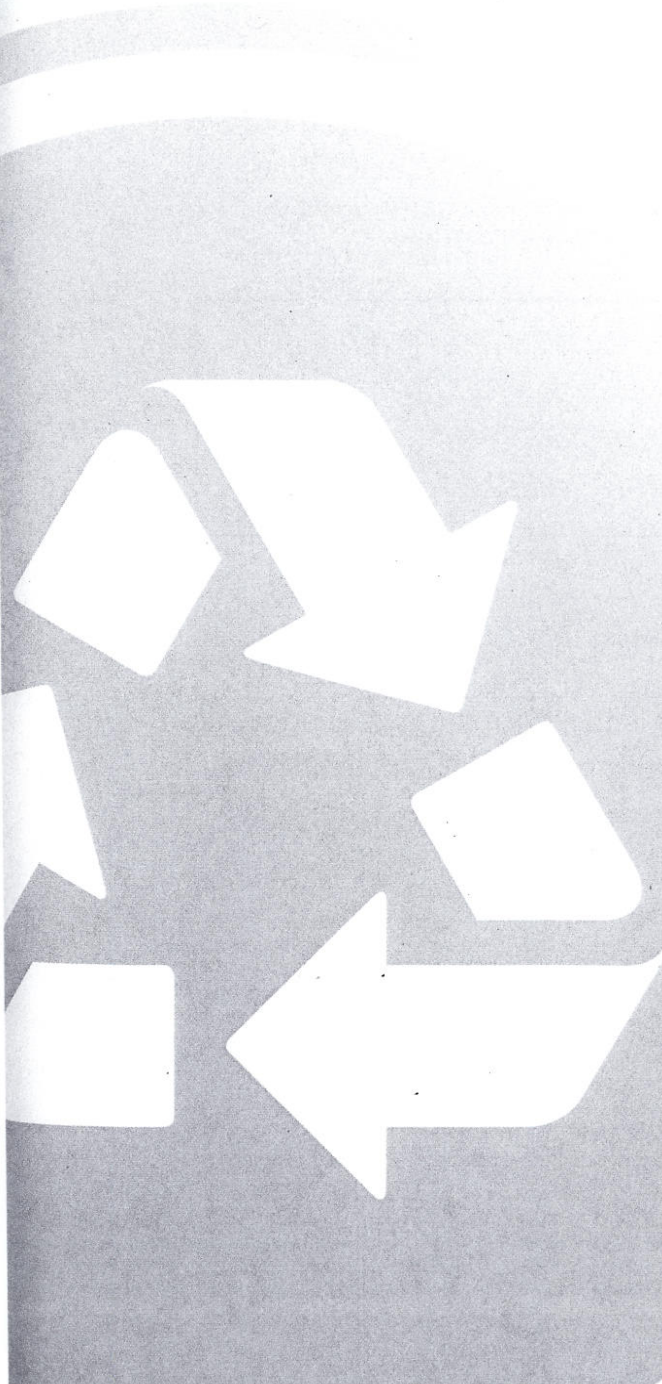


MATERIALS AND RESOURCES



Buildings generate a large amount of waste throughout their life cycles, from construction and building operations to demolition. The amount of waste leaving the property can be reduced, however, through responsible procurement choices, as well as by implementing comprehensive recycling programs throughout the construction, operation, and demolition phases. Consideration for materials and resources focuses on the health and productivity consequences of material selections for building occupants, plus the long-term social, economic, and environmental impacts of materials used in the design and construction of the building.

Green building addresses two kinds of problems related to materials and resources:

- waste management; and
- life-cycle impacts.

LEED recognizes and encourages strategies that consider materials and resources from a long-term, life-cycle perspective.

Assessments and Measurements

- **Rapidly renewable materials.** The amount of a building's agricultural products (fiber or animal) that are quickly grown or raised and can be harvested in a sustainable fashion, expressed as a percentage of the total materials cost. For LEED, rapidly renewable materials take 10 years or less to grow or raise.
- **Recycled content.** The percentage of material in a product that is recycled from the manufacturing waste stream (preconsumer waste) or the consumer waste stream (postconsumer waste) and used to make new materials. For LEED, recycled content is typically expressed as a percentage of the total material volume or weight.
- **Regional materials.** The amount of a building's materials that are extracted, processed, and manufactured close to a project site, expressed as a percentage of the total materials cost. For LEED, regional materials originate within 500 miles of the project site.
- **Reuse.** The amount of building materials returned to active use (in the same or a related capacity as their original use), expressed as a percentage of the total materials cost of a building. The salvaged materials are incorporated into the new building, thereby extending the lifetime of materials that would otherwise be discarded.
- **Sustainable forestry.** The practice of managing forest resources to meet the long-term forest product needs of humans while maintaining the biodiversity of forested landscapes.
- **Waste diversion.** The amount of waste disposed other than through incineration or in landfills, expressed in tons. Examples of waste diversion include reuse and recycling.

THINK ABOUT IT

Materials matter. Which is more sustainable, a wood building or a steel building? Why?

WASTE MANAGEMENT

The intent of LEED credits in this category is to reduce the waste and toxins that are hauled to and disposed of in landfills or incineration facilities. During construction or renovation, materials should be recycled or reused whenever possible. During the daily operation of the building, recycling, reuse, and reduction programs can curb the amount of material destined for local landfills.

Strategies for reducing waste:

- **Size the building appropriately.** Carefully match the size of the building to its intended function and owner's requirements. It may be possible to achieve the desired functions with a smaller building, thereby saving energy and reducing operating costs.
- **Develop a construction waste management policy.** Outline procedures and goals for construction waste diversion. This policy should specify a target diversion rate for the general contractor.

- **Encourage recycling.** Establish a waste reduction policy for operations and maintenance. Provide occupants with easily accessible collectors for recyclables, and monitor the effectiveness of the policy.
- **Compost.** Institute an onsite composting program to turn landscaping debris into mulch.

Primary Resources: Waste reduction

Solid waste is continually generated in most buildings as new products arrive and used materials leave as waste. This waste is transported to landfills or sometimes incinerated to generate energy. In either case, the disposal of solid waste produces greenhouse gas emissions. In landfills, a portion of the waste decays and produces methane—a potent greenhouse gas. Incineration of waste produces carbon dioxide as a byproduct. The result is that solid waste ultimately contributes directly to substantial greenhouse gas emissions.

EPA has estimated greenhouse gas emissions from building waste streams and finds that the United States currently recycles approximately 32% of its solid waste—the carbon dioxide equivalent of removing almost 40 million cars from the road. EPA estimates that improving recycling rates to just 35% could save more than 5 million metric tons of carbon dioxide equivalent. The construction and operation of green buildings can be an important part of achieving these reductions.

- Construction Materials Recycling Association. www.cdrecycling.org.
- Recycled content product directory (California Integrated Waste Management Board). www.ciwmb.ca.gov/rcp.
- Solid waste and greenhouse gas emissions (U.S. EPA). <http://www.epa.gov/climatechange/wycd/waste/generalinfo.html>.
- Waste Reduction Model (WARM) (U.S. EPA). www.epa.gov/warm.

THINK ABOUT IT

Embodied energy and emissions of solid waste. Many landfills burn the gas that seeps from buried piles of trash and garbage, and in some cases, this practice qualifies as a widely recognized method for creating “carbon offsets”—real, durable, verified reductions in greenhouse gas emissions. Why is burning landfill gas considered a reduction in greenhouse gas emissions? In other cases, landfill gas may be captured and used as fuel to generate electricity.

LIFE-CYCLE IMPACTS

LEED increasingly incorporates strategies intended to reduce the environmental impacts of materials acquired for construction, operation, maintenance, and upgrades of a building. To embed these strategies in the building's construction and operations processes, teams develop environmentally responsible procurement policies.

Strategies to promote sustainable purchasing during construction:

- **Develop a construction purchasing policy.** Outline the goals, thresholds, and procedures for procurement of construction materials. Monitor compliance and track the effectiveness of the policy to ensure that it is working.
- **Specify green materials.** Rapidly renewable materials, regional materials, salvaged materials, and materials with recycled content reduce environmental impacts and promote sustainable material sources.
- **Specify green interiors.** Use finishes, carpets, fabric, and other materials with low levels of volatile organic compounds (VOCs), formaldehyde, and other potentially toxic chemicals to protect indoor environmental quality and reduce the life-cycle impacts of materials.

Strategies to promote sustainable purchasing during operations:

- **Develop a sustainable purchasing policy.** Outline the goals, thresholds, and procedures for procurement of ongoing consumables and durable goods. Monitor compliance to ensure that the policy is effective.
- **Specify green materials.** Give preference to rapidly renewable materials, regional materials, salvaged materials, and materials with recycled content.
- **Specify green electronic equipment.** Choose computers and appliances that meet ENERGY STAR, EPEAT, or other standards for efficient energy consumption.

THINK ABOUT IT

Sustainable product certification. Evaluating the sustainability of green products is complex, and competing claims make it difficult to determine the relative merits of many products. Third-party programs such as the Forest Stewardship Council and Green Seal offer independent measures of performance, but certifiers' varying and even conflicting standards can create confusion. What are the pros and cons of different approaches to evaluating the sustainability of materials?

Primary Resources: Estimating life-cycle impacts

Quantitative life-cycle assessment (LCA) involves an objective comparison of alternative design and construction practices. It relies on models and database-driven tools to analyze the environmental aspects and potential impacts associated with a product, process, or service. Several tools can help project teams conduct life-cycle assessments:

- **BEES 3.0 (Building for Environmental and Economic Sustainability).** This software tool helps balance the environmental and economic performance of building products. It is based on consensus standards and designed to be practical, flexible, consistent, and transparent. Visit <http://www.wbdg.org/tools/bees.php>.
- **Construction carbon calculator.** This Web-based tool helps developers, builders, architects, and land planners estimate the net embodied carbon of a project's structures and site. Visit <http://buildcarbonneutral.org/>.
- **EcoCalculator for assemblies.** This tool is used by architects, engineers, and other building professionals to characterize hundreds of design options based on databases, such as the U.S. Life Cycle Inventory Database from the Department of Energy's National Renewable Energy Laboratory. Visit <http://www.athenasmi.org/tools/docs/EcoCalculatorFactSheet.pdf>.
- **EPEAT.** The Electronic Product Environmental Assessment Tool assists with the evaluation, comparison, and selection of computers and monitors based on their environmental attributes. See <http://www.epeat.net/>.

INDOOR ENVIRONMENTAL QUALITY

According to EPA, Americans spend 90% of their time indoors, where concentrations of pollutants may be significantly higher than outdoor levels.⁷ Consequently, indoor environmental quality is a major concern in buildings.

Strategies to improve indoor environmental quality have the potential to enhance the lives of building occupants, increase the resale value of the building, and reduce liability for building owners. Personnel costs—primarily salaries and benefits—are much larger than the typical building's operating costs, like electricity and maintenance. Thus, strategies that improve employee health and productivity over the long run can have a large return on investment. Moreover, preventing problems is generally much less expensive than dealing with any illnesses and loss of productivity stemming from poor indoor environmental quality. Building owners, designers, and operators should aim

⁷ EPA Green Building Workgroup, <http://www.epa.gov/greenbuilding/>.

to provide stimulating and comfortable environments for the occupants and minimize the risk of building-related health problems. Meeting this goal requires attention to two kinds of issues:

- indoor air quality; and
- thermal comfort, lighting, and acoustics.

Assessments and Measurements

- **Carbon dioxide concentrations.** An indicator of ventilation effectiveness inside buildings. CO₂ concentrations greater than 530 parts per million (ppm) above outdoor conditions generally indicate inadequate ventilation. Absolute concentrations of greater than 800 to 1,000 ppm generally indicate poor air quality for breathing. CO₂ builds up in a space when there is not enough ventilation.
- **Controllability of systems.** The percentage of occupants who have direct control over temperature, airflow, and lighting in their spaces.
- **Minimum efficiency reporting value (MERV).** A rating that indicates the efficiency of air filters in the mechanical system. MERV ratings range from 1 (very low efficiency) to 16 (very high).
- **Thermal comfort.** The temperature, humidity, and airflow ranges within which the majority of people are most comfortable, as determined by ASHRAE Standard 55–2004. Because people dress differently depending on the season, thermal comfort levels vary with the season. Control setpoints for HVAC systems should vary accordingly to ensure that occupants are comfortable and energy is conserved.
- **Ventilation rate.** The amount of air circulated through a space, measured in air changes per hour (the quantity of infiltration air in cubic feet per minute divided by the volume of the room). Proper ventilation rates, as prescribed by ASHRAE Standard 62, ensure that enough air is supplied for the number of occupants to prevent accumulation of carbon dioxide and other pollutants in the space.
- **Volatile organic compounds (VOCs).** The amount of carbon compounds that participate in atmospheric photochemical reactions and vaporize (become a gas) at normal room temperatures, measured in grams per liter. VOCs off-gas from many materials, including adhesives, sealants, paints, carpets, and particle board. Limiting VOC concentrations protects the health of both construction personnel and building occupants.

THINK ABOUT IT

Biophilia. Humans evolved with a strong connection to nature. How can buildings reflect this connection? What are the benefits?

INDOOR AIR QUALITY

Protecting indoor environments from contaminants—such as volatile organic compounds (VOCs), carbon dioxide, particulates, and tobacco smoke—is essential to maintaining good indoor air quality. Off-gassing from furniture, carpets, paints, and cleaning products, plus human respiration, can create an indoor atmosphere that is hundreds of times more polluted than the outdoor environment. Ventilation is one effective way to control the concentration of pollutants indoors. New low-emitting alternatives for interior finish materials are another; these products do not add pollutants to indoor environments and should be used in new building construction and renovations.

Strategies for maintaining indoor air quality:

- **Prohibit smoking.** Institute a no-smoking policy in the building and around building entrances, operable windows, and air intakes.
- **Ensure adequate ventilation.** Appropriately size and operate ventilation systems to supply ample outside air to the occupants. Follow the most recent industry standards (such as ASHRAE Standard 62, Ventilation for Acceptable Indoor Air Quality).
- **Monitor carbon dioxide.** Install monitors and integrate them with a ventilation system that regulates the supply of air based on occupant demand. With demand-controlled ventilation, air flow is automatically increased if concentrations exceed a setpoint.
- **Install high-efficiency air filters.** Use filters with high MERV ratings in the ventilation equipment.
- **Specify low-emitting materials.** Use green materials for both new construction and renovations.
- **Protect air quality during construction.** Prevent mold by protecting all materials from moisture exposure. Prevent dust and particulate buildup.
- **Conduct a flush-out.** Before occupancy, flush out indoor airborne contaminants by thoroughly exhausting old air and replacing it with outdoor air.
- **Employ a green cleaning program.** Select cleaning products and technologies to minimize the introduction of contaminants and the exposure of custodial staff.
- **Use integrated pest management.** A coordinated program of nonchemical strategies, such as monitoring and baiting, can reduce the use of pesticides and other potentially toxic contaminants.

THERMAL COMFORT, LIGHTING, AND ACOUSTICS

Thermal comfort, lighting, and acoustics are other major aspects of indoor environmental quality that have a significant impact on occupants. Access to daylight and views, a comfortable temperature, and good lighting and acoustic conditions can enhance occupants' sense of satisfaction in their space. These factors have been shown to improve human health and productivity. It has also been shown that occupants are more satisfied with their

environment if they have control over these aspects. For example, the ability to open or close a window in their office allows workers to adapt to and tolerate temperatures outside the comfort zone in a sealed building environment.

Strategies for improving thermal comfort, lighting, and acoustics in indoor environments:

- **Use daylighting.** Design the building to provide ample access to natural daylight and views for the occupants. Service areas, equipment rooms, closets, and locker rooms should be located in the building core, and regularly occupied spaces placed around the perimeter of the building.
- **Install operable windows.** If possible, provide windows that can be opened to the outside.
- **Give occupants temperature control.** In mechanically ventilated buildings, provide thermostats that allow occupants to control the temperature in their immediate environment.
- **Give occupants ventilation control.** In mechanically ventilated buildings, provide adjustable air diffusers that allow occupants to adjust the air flow to their immediate environment.
- **Give occupants lighting control.** Provide occupants with adjustable lighting controls so that they can match lighting levels to their tasks.
- **Conduct occupant surveys.** Use valid survey protocols to assess occupants' satisfaction with the indoor environment. Make operational changes based on the feedback.

THINK ABOUT IT

Thermal comfort. Experiments to determine thermal comfort norms for humans were performed in carefully controlled laboratory environments where people were subjected to various environmental conditions. The standards that were developed through this research advised designers and operators to keep building environments within strictly defined ranges. However, recent research in real-world situations has shown that people are tolerant of more varied conditions when they have control over their environment. What are the energy efficiency implications of design that accommodates personal control over one's environment?

Primary Resources: Daylighting

A study of more than 2,000 California classrooms found that students in classrooms with the most daylight progressed 20% faster in math and 26% faster in reading than students in the classrooms with the least amount of natural light.

- *Daylight and Retail Sales* (California Energy Commission, 2003). http://www.h-m-g.com/downloads/Daylighting/A-5_Daylgt_Retail_2.3.7.pdf.
- "Daylighting in Schools: An Investigation into the Relationship between Daylighting and Human Performance" (Heschong Mahone Group, 1999).
- "Healthier, Wealthier, Wiser: A Report on National Green Schools" (Global Green USA, no date). <http://www.globalgreen.org/publications/>.
- *Windows and Classrooms: A Study of Student Performance and the Indoor Environment* (California Energy Commission, 2003). http://www.h-m-g.com/downloads/Daylighting/A-7_Windows_Classrooms_2.4.10.pdf.
- *Windows and Offices: A Study of Office Worker Performance and the Indoor Environment* (California Energy Commission, 2003). http://www.h-m-g.com/downloads/Daylighting/A-9_Windows_Offices_2.6.10.pdf.

Indoor environmental quality

Studies by the Center for the Built Environment at the University of California–Berkeley find that occupants of green buildings report significantly greater satisfaction with indoor air quality than occupants of conventional buildings. However, the benefits of green building do not extend to all aspects of indoor environmental quality. The green buildings often had superior air quality but provided less satisfaction on measures of acoustic quality.

- Indoor Environment Department, Lawrence Berkeley National Laboratory. <http://eetd.lbl.gov/ied/ied.html>.
- Indoor health and productivity. <http://www.ihpcentral.org>.
- "Occupant Satisfaction with Indoor Environmental Quality in Green Buildings" (Center for the Built Environment, 2006).

INNOVATION AND DESIGN

The LEED rating systems offer Innovation and Design credits to encourage projects to go above and beyond the credit requirements and explore innovative green building strategies. LEED recognizes two strategies for earning ID credits: exceptional performance and innovation.

Exceptional performance strategies surpass the requirements of existing LEED credits and substantially exceed the performance-based standards for energy, water, or waste management. LEED has recognized the following kinds of exceptional performance:

- doubling density requirements for Sustainable Sites credits;
- significantly reducing indoor water use beyond the LEED requirement of 40%;
- significantly diverting construction waste beyond the requirement of 75%; and
- providing more daylighting than the 75% requirement.

Innovative strategies expand the breadth of green building practice and introduce new ideas, such as these recent innovative strategies:

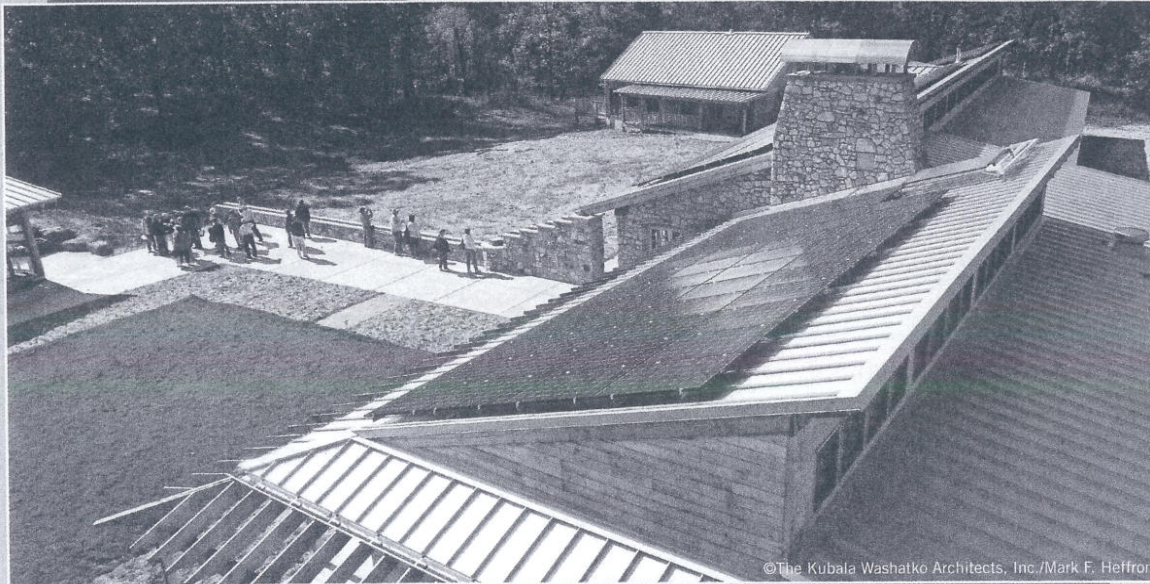
- developing an educational outreach program;
- using a greenhouse gas budget to demonstrate carbon-neutral design and operations; and
- incorporating high levels of fly ash in concrete to divert waste material from landfills.

Strategies and practices rewarded as innovative today may become credits in the future. In fact, as LEED continues to evolve and today's innovation becomes tomorrow's standard, strategies that may have earned ID credit in the past may not necessarily earn recognition in current or future projects.

Primary Resource: Guidance on innovation and design credits

Requirements for documenting the achievement of Innovation and Design credits is available from USGBC, at http://www.usgbc.org/Docs/LEEDdocs/IDcredit_guidance_final.pdf.

Project Case Study



The Aldo Leopold Legacy Center

The Aldo Leopold Legacy Center was the first building recognized by USGBC as carbon neutral—an exceptional achievement that earned the center an Innovation and Design credit. The project team prepared a greenhouse gas emissions budget based on the requirements of the World Resources Institute Greenhouse Gas Protocol. Conservatively accounting for carbon generation and sequestration in metric tons of CO₂ equivalent (a measure of greenhouse gas emissions that combines multiple heat-trapping gases, such as carbon dioxide, methane, and nitrous oxide), the activities of the center will result in the net *reduction* of CO₂ emissions each year.

Projected annual greenhouse gas emissions from Aldo Leopold Legacy Center

	CO ₂ equivalent per year (metric tons)	
Total emissions		13.42
Offset from renewable energy	-6.24	
Onsite forest sequestration	-8.75	
Total emissions reduction		-14.99
Net balance of emissions		-1.57

More information about the Aldo Leopold Legacy Center is available at <http://www.aldoleopold.org/legacycenter/carbonneutral.html>.

GLOSSARY

acid rain the precipitation of dilute solutions of strong mineral acids, formed by the mixing in the atmosphere of various industrial pollutants (primarily sulfur dioxide and nitrogen oxides) with naturally occurring oxygen and water vapor.

adapted plants nonnative, introduced plants that reliably grow well in a given habitat with minimal winter protection, pest control, fertilization, or irrigation once their root systems are established. Adapted plants are considered low maintenance and not invasive.

air quality standards the level of pollutants prescribed by regulations that are not to be exceeded during a given time in a defined area. (EPA)

alternative fuel vehicles vehicles that use low-polluting, nongasoline fuels, such as electricity, hydrogen, propane or compressed natural gas, liquid natural gas, methanol, and ethanol. In LEED, efficient gas-electric hybrid vehicles are included in this group.

ambient temperature the temperature of the surrounding air or other medium. (EPA)

ASHRAE American Society of Heating, Refrigerating and Air-Conditioning Engineers.

bake-out a process used to remove volatile organic compounds (VOCs) from a building by elevating the temperature in the fully furnished and ventilated building prior to human occupancy.

biodegradable capable of decomposing under natural conditions. (EPA)

biodiversity the variety of life in all forms, levels, and combinations, including ecosystem diversity, species diversity, and genetic diversity.

biomass plant material from trees, grasses, or crops that can be converted to heat energy to produce electricity.

bioswale a stormwater control feature that uses a combination of an engineered basin, soils, and vegetation to slow and detain stormwater, increase groundwater recharge, and reduce peak stormwater runoff.

blackwater wastewater from toilets and urinals; definitions vary, and wastewater from kitchen sinks (perhaps differentiated by the use of a garbage disposal), showers, or bathtubs is considered blackwater under some state or local codes.

British thermal unit (Btu) the amount of heat required to raise the temperature of one pound of liquid water from 60° to 61° Fahrenheit. This standard measure of energy is used to describe the energy content of fuels and compare energy use.

brownfield real property whose use may be complicated by the presence or possible presence of a hazardous substance, pollutant, or contaminant.

building density the floor area of the building divided by the total area of the site (square feet per acre).

building envelope the exterior surface of a building—the walls, windows, roof, and floor; also referred to as the building shell.

building footprint the area on a project site that is used by the building structure, defined by the perimeter of the building plan. Parking lots, landscapes, and other nonbuilding facilities are not included in the building footprint.

byproduct material, other than the principal product, generated as a consequence of an industrial process or as a breakdown product in a living system. (EPA)

carbon footprint a measure of greenhouse gas emissions associated with an activity. A comprehensive carbon footprint includes building construction, operation, energy use, building-related transportation, and the embodied energy of water, solid waste, and construction materials.

chiller a device that removes heat from a liquid, typically as part of a refrigeration system used to cool and dehumidify buildings.

commissioning (Cx) the process of verifying and documenting that a building and all of its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements.

commissioning plan a document that outlines the organization, schedule, allocation of resources, and documentation requirements of the commissioning process.

commissioning report a document that details the commissioning process, including a commissioning program overview, identification of the commissioning team, and description of the commissioning process activities.

compact fluorescent lamp (CFL) a small fluorescent lamp, used as a more efficient alternative to incandescent lighting; also called a PL, twin-tube, or biax lamp. (EPA)

construction and demolition debris waste and recyclables generated from construction and from the renovation, demolition, or deconstruction of preexisting structures. It does not include land-clearing debris, such as soil, vegetation, and rocks.

construction waste management plan a plan that diverts construction debris from landfills through recycling, salvaging, and reusing.

contaminant an unwanted airborne element that may reduce indoor air quality (ASHRAE Standard 62.1-2007).

cooling tower a structure that uses water to absorb heat from air-conditioning systems and regulate air temperature in a facility.

daylighting the controlled admission of natural light into a space, used to reduce or eliminate electric lighting.

dry ponds excavated areas that detain stormwater and slow runoff but are dry between rain events. Wet ponds serve a similar function but are designed to hold water all the time.

ecosystem a basic unit of nature that includes a community of organisms and their nonliving environment linked by biological, chemical and physical process.

energy-efficient products and systems building components and appliances that use less energy to perform as well as or better than standard products.

energy management system a control system capable of monitoring environmental and system loads and adjusting HVAC operations accordingly in order to conserve energy while maintaining comfort. (EPA)

ENERGY STAR® rating a measure of a building's energy performance compared with that of similar buildings, as determined by the ENERGY STAR Portfolio Manager. A score of 50 represents average building performance.

environmental sustainability long-term maintenance of ecosystem components and functions for future generations. (EPA)

flush-out the operation of mechanical systems for a minimum of two weeks using 100 percent outside air at the end of construction and prior to building occupancy to ensure safe indoor air quality.

fossil fuel energy derived from ancient organic remains, such as peat, coal, crude oil, and natural gas. (EPA).

graywater domestic wastewater composed of wash water from kitchen, bathroom, and laundry sinks, tubs, and washers. (EPA) The Uniform Plumbing Code (UPC) defines graywater in its Appendix G, Gray Water Systems for Single-Family Dwellings, as "untreated household waste water which has not come into contact with toilet waste. Greywater includes used water from bathtubs, showers, bathroom wash basins, and water from clothes-washer and laundry tubs. It

must not include waste water from kitchen sinks or dishwashers.” The International Plumbing Code (IPC) defines graywater in its Appendix C, Gray Water Recycling Systems, as “waste water discharged from lavatories, bathtubs, showers, clothes washers and laundry sinks.” Some states and local authorities allow kitchen sink wastewater to be included in graywater. Other differences with the UPC and IPC definitions can likely be found in state and local codes. Project teams should comply with graywater definitions as established by the authority having jurisdiction in the project area.

harvested rainwater precipitation captured and used for indoor needs, irrigation, or both.

heat island effect the absorption of heat by hardscapes, such as dark, nonreflective pavement and buildings, and its radiation to surrounding areas. Particularly in urban areas, other sources may include vehicle exhaust, air-conditioners, and street equipment; reduced airflow from tall buildings and narrow streets exacerbates the effect.

high-performance green building a structure designed to conserve water and energy; use space, materials, and resources efficiently; minimize construction waste; and create a healthful indoor environment.

HVAC systems equipment, distribution systems, and terminals that provide the processes of heating, ventilating, or air-conditioning. (ASHRAE Standard 90.1-2007)

indoor air quality the nature of air inside the space that affects the health and well-being of building occupants. It is considered acceptable when there are no known contaminants at harmful concentrations and a substantial majority (80% or more) of the occupants do not express dissatisfaction. (ASHRAE Standard 62.1-2007)

integrated design team all the individuals involved in a building project from early in the design process, including the design professionals, the owner’s representatives, and the general contractor and subcontractors.

LEED credit an optional LEED Green Building Rating System™ component whose achievement results in the earning of points toward certification.

LEED credit interpretation request a formal USGBC process in which a project team experiencing difficulties in the application of a LEED prerequisite or credit can seek and receive clarification, issued as a **credit interpretation ruling**. Typically, difficulties arise when specific issues are not directly addressed by LEED reference guides or a conflict between credit requirements arises.

LEED intent the primary goal of each prerequisite or credit.

LEED® Rating System™ a voluntary, consensus-based, market-driven building rating system based on existing, proven technology. The LEED Green Building Rating System™ represents

USGBC's effort to provide a national benchmark for green buildings. Through its use as a design guideline and third-party certification tool, the LEED Green Building Rating System aims to improve occupant well-being, environmental performance, and economic returns using established and innovative practices, standards, and technologies.

LEED prerequisite a required LEED Green Building Rating System™ component whose achievement is mandatory and does not earn any points.

LEED technical advisory group (TAG) a committee consisting of industry experts who assist in interpreting credits and developing technical improvements to the LEED Green Building Rating System™.

life-cycle assessment an analysis of the environmental aspects and potential impacts associated with a product, process, or service.

market transformation systematic improvements in the performance of a market or market segment. For example, EPA's ENERGY STAR program has shifted the performance of homes, buildings, and appliances toward higher levels of energy efficiency by providing recognition and comparative performance information through its ENERGY STAR labels.

native (or indigenous) plants plants adapted to a given area during a defined time period. In North America, the term often refers to plants growing in a region prior to the time of settlement by people of European descent. Native plants are considered low maintenance and not invasive.

nonpotable water. See **potable water.**

nonrenewable not capable of being replaced; permanently depleted once used. Examples of nonrenewable energy sources are oil or natural gas, and nonrenewable natural resources include metallic ores.

off-gassing the emission of volatile organic compounds from synthetic and natural products.

particulates solid particles or liquid droplets in the atmosphere. The chemical composition of particulates varies, depending on location and time of year. Sources include dust, emissions from industrial processes, combustion products from the burning of wood and coal, combustion products associated with motor vehicle or nonroad engine exhausts, and reactions to gases in the atmosphere. (EPA)

perviousness the percentage of the surface area of a paving material that is open and allows moisture to pass through the material and soak into the ground below.

photovoltaic (PV) energy electricity from photovoltaic cells that convert the energy in sunlight into electricity.

pollutant any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems. (EPA) Air pollutants include emissions of carbon dioxide (CO₂), sulfur dioxide (SO₂), nitrogen oxides (NO_x), mercury (Hg), small particulates (PM_{2.5}), and large particulates (PM₁₀).

postconsumer recycled content the percentage of material in a product that was consumer waste. The recycled material was generated by household, commercial, industrial, or institutional end users and can no longer be used for its intended purpose. It includes returns of materials from the distribution chain. Examples include construction and demolition debris, materials collected through recycling programs, discarded products (e.g., furniture, cabinetry, decking), and landscaping waste (e.g., leaves, grass clippings, tree trimmings). (ISO 14021)

potable water water that meets or exceeds EPA's drinking water quality standards and is approved for human consumption by the state or local authorities having jurisdiction; it may be supplied from wells or municipal water systems.

preconsumer recycled content the percentage of material in a product that was recycled from manufacturing waste. Preconsumer content was formerly known as postindustrial content. Examples include planer shavings, sawdust, bagasse, walnut shells, culls, trimmed materials, overissue publications, and obsolete inventories. Excluded are rework, regrind, or scrap materials capable of being reclaimed within the same process that generated them. (ISO 14021)

rain garden a stormwater management feature consisting of an excavated depression and vegetation that collect and infiltrate runoff and reduce peak discharge rates.

rainwater harvesting the collection and storage of precipitation from a catchment area, such as a roof.

rapidly renewable materials agricultural products, both fiber and animal, that take 10 years or less to grow or raise and can be harvested in a sustainable fashion.

regenerative design sustainable plans for built environments that improve existing conditions. Regenerative design goes beyond reducing impacts to create positive change in the local and global environment.

renewable energy resources that are not depleted by use. Examples include energy from the sun, wind, and small (low-impact) hydropower, plus geothermal energy and wave and tidal systems. Ways to capture energy from the sun include photovoltaic, solar thermal, and bioenergy systems based on wood waste, agricultural crops or residue, animal and other organic waste, or landfill gas.

renewable energy certificate (REC) a tradable commodity representing proof that a unit of electricity was generated from a renewable energy resource. RECs are sold separately from the electricity itself and thus allow the purchase of green power by a user of conventionally generated electricity.

salvaged material construction items recovered from existing buildings or construction sites and reused. Common salvaged materials include structural beams and posts, flooring, doors, cabinetry, brick, and decorative items.

sick building syndrome (SBS) a combination of symptoms, experienced by occupants of a building, that appear to be linked to time spent in the building but cannot be traced to a specific cause. Complaints may be localized in a particular room or zone or be spread throughout the building. (EPA)

stormwater runoff water from precipitation that flows over surfaces into sewer systems or receiving water bodies. All precipitation that leaves project site boundaries on the surface is considered stormwater runoff.

sustainability meeting the needs of the present without compromising the ability of future generations to meet their own needs. (Brundtland Commission)

sustainable forestry management of forest resources to meet the long-term forest product needs of humans while maintaining the biodiversity of forested landscapes. The primary goal is to restore, enhance, and sustain a full range of forest values, including economic, social, and ecological considerations.

sustained-yield forestry management of a forest to produce in perpetuity a high-level annual or regular periodic output, through a balance between increment and cutting. (Society of American Foresters)

thermal comfort the condition that exists when occupants express satisfaction with the thermal environment.

volatile organic compound (VOC) a carbon compound that participates in atmospheric photochemical reactions (excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides and carbonates, and ammonium carbonate). Such compounds vaporize (become a gas) at normal room temperatures.

wastewater the spent or used water from a home, community, farm, or industry that contains dissolved or suspended matter. (EPA)

wetland vegetation plants that require saturated soils to survive or can tolerate prolonged wet soil conditions.

xeriscaping a landscaping method that makes routine irrigation unnecessary by using drought-adaptable and low-water plants, as well as soil amendments such as compost and mulches to reduce evaporation.