
Green Construction

*An introduction to
a changing industry*

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Also by the Author

Construction Project Management: A Complete Introduction
LEED Certification: An Introduction to Certifying a Green Building

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Glossary

2030 Challenge—a call to the design and construction communities that all new and renovated buildings will be zero net energy by 2030.

Academic degree—a post-secondary credential offered by colleges and universities.

Air changes—how much air circulates in and out of a room.

Air quality—a measurement of the pollutants in the air.

ANSI (American National Standards Institute)—certifies standards developed by other organizations.

Architect—see Designer.

ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers)—a source of technical standards for the HVAC industry.

ASTM International (formerly American Society for Testing and Materials)—develops standards for a wide range of products, materials, and systems.

Authority Having Jurisdiction (AHJ)—an agency such as a city's building department with jurisdiction over a project.

Biomass—any organic matter that can be burned for energy.

Bioswales—vegetation-filled depressions used to manage runoff.

Blackwater—wastewater that includes human waste.

BREEAM (Building Research Establishment Environmental Assessment Method)—developed in 1990 by the Building Research Establishment in

Great Britain, a design and assessment method for sustainable buildings; it was the model for LEED.

Brownfield—a site that has hazardous substances, pollutants, or contaminants from an earlier use.

BTU (British thermal unit)—a unit of energy equivalent to the heat produced by a single lit kitchen match and measured in watts.

Building assessment program—an evaluation tool for measuring the qualities and nature of a building; often used interchangeably with building rating system.

Building codes—mandatory requirements that promote safe practices in the design and construction of buildings.

Building envelope—the physical separators between the parts of a building that are heated and cooled (conditioned) and those parts that are not.

Building Information Modeling (BIM)—a process of gathering and managing information that uses 3D virtual models as a tool for design, construction, and facilities management.

Building-integrated photovoltaics (BIPVs)—systems that integrate photovoltaic solar cells directly into building materials.

Building rating system—an evaluation tool for measuring the qualities and nature of a building; often used interchangeably with building assessment program.

Built environment—human-made buildings and parks, transportation systems, energy and water infrastructure, and all the other constructed components that form our surroundings.

CALGreen—California's statewide building energy standards code.

Capacity—the amount of heating or cooling a piece of HVAC equipment can provide under optimum conditions.

Certificate—a voluntary non-degree credential.

Certification—a document used to demonstrate that a product, system, or building has met certain performance criteria.

Closed shop—a place of work where the employer agrees to hire union members only.

Close-out—the process of completing the terms of a contract; includes completion of the physical work (construction close-out), completion of fulfilling the terms of the construction contract (contract close-out), and final evaluations by the contractor (contractor close-out). On a green project, close-out includes submittal of required documentation.

Codes—laws put into place to promote safe practices in design and construction; compliance is enforced through whichever agency has jurisdiction over the project.

Commercial sector—a sector of the construction industry that includes offices, large apartment complexes, theaters, schools, hospitals, and other such facilities.

Commissioning—a process of verifying that building systems and equipment are installed as specified and the building is operating at optimal performance. Commissioning can occur during design, construction, and operation.

Commissioning agent—member of the project team who coordinates the commissioning process.

Compliance—conformity in fulfilling official requirements.

Concentrating photovoltaic (CPV) systems—systems that generate electric power by concentrating sunlight or thermal energy on photovoltaic cells. Not to be confused with concentrating solar power (CSP) systems.

Concentrating solar power (CSP) systems—systems that use a mechanism to reflect sunlight onto a focal point to create heat or steam. Not to be confused with concentrating photovoltaic (CPV) systems.

Conservation—the act of trying to protect or preserve something or the limiting of how much of a resource is used.

Construction—the execution of physical work as outlined in contract documents.

Construction and demolition (C&D) waste—the materials that are discarded from the renovation of existing buildings, the demolition of old buildings, and the construction of new buildings and infrastructure.

Construction industry—the sector of the economy that is engaged with the construction, alteration, maintenance, and repair of systems, buildings, structures, infrastructure, and other real property.

Construction management—the process of coordinating, monitoring, evaluating, and controlling a construction project; not to be confused with the specific delivery method known as construction management project delivery.

Construction management project delivery—a delivery method in which a contract manager is hired early in the process and acts as the owner's representative. During construction, the contract manager may either manage (but not physically complete the work) or perform as a general contractor.

Contract documents—the drawings and other written, printed, or electronic matter that make up the contractor's legal agreement with the owner.

Contract manager—an individual or firm, hired as an owner's representative during preconstruction under a Construction management project delivery method; the contract manager typically coordinates completion of the physical work.

Contractor (also called constructor or builder)—an individual or firm that agrees to construct a project in accordance with contract documents (the drawings and other written, printed, or electronic matter that make up the contractor's legal agreement with the owner).

Conventional buildings—a building that meets but does not exceed basic code requirements.

Credential—recognition by a qualified agent that an individual has met certain criteria and passed an assessment in a subject.

Credentialing—the umbrella term used to describe a process whereby a qualified agent (such as a state license board or another organization or agency) grants recognition that an individual has met certain criteria and, typically, passed an assessment test.

Decommissioning—the process of taking something (such as a building) out of service.

Deep-green retrofits—efforts that result in energy savings of 50% or more, as measured against a pre-renovation baseline.

Delivered energy—the amount of energy consumed at an end point.

Delivery method—the organizational structure for completing a project; also called project delivery.

Demand—the amount of heating or cooling a building needs; also called “load.”

Design-bid-build delivery method—a system of organizing a project in which a general contractor is hired on a lump-sum-bid basis after design is complete; also called a traditional/lump-sum delivery method.

Design-Build delivery method—a system of organizing projects marked by the owner hiring a single firm to provide both design and construction services.

Designer—an individual or firm that provides planning, design, and construction administration services to a project; they are typically licensed architects or engineers.

Developer—a private owner who coordinates the tasks required to create a project.

Drip irrigation—systems that slowly deliver water directly to the root zone of a plant, with almost no water loss through surface runoff or evaporation.

Dual-flush toilets—toilets that are based on the standard toilets but have two buttons that allow for different flushing options.

Durability—a measure of the anticipated useful life of a system or product before it must be removed and replaced.

Efficient—see Energy efficiency.

Electrical energy—the energy made available by the flow of a charged particle through a conductor.

Embodied energy—the energy required to extract, process, manufacture, transport, and install a material or product.

Energy—the ability to do work. Different forms of energy can be converted to other forms, but the total amount of energy remains the same.

Energy consumption—the amount of energy used by a product, process, or system.

Energy efficiency—the percentage of total energy consumed in useful work (and not wasted) relative to the amount of energy supplied.

Energy infrastructure—facilities required to turn raw ingredients into useful forms of power and deliver it to users, including the pipes, trucks, and rail lines that transport oil and natural gas, and the transmission lines that move electricity.

Energy Star—an energy-rating program for residential and commercial buildings developed by the U.S. Department of Energy and the U.S. Environmental Protection Agency.

Environmental product declaration (EPD)—a detailed report developed by a manufacturer that lists product ingredients and environmental impacts that occur over the entire life cycle of a product.

EPA (U.S. Environmental Protection Agency)—an agency of the federal government whose mission is to protect human health and the environment.

Evacuated tube collectors—solar thermal systems that use glass tubes surrounded by absorber plates.

Facility manager—employed by the owner to ensure that all systems are operated and maintained properly in a building, plant, or complex after occupancy.

Fenestration—the arrangement of windows and doors on the elevation of a building.

Finish materials—materials such as drywall, wallpaper, paints, and so on that are used to form decorative and protective coatings.

Flat plate PV system—a group of solar photovoltaic panels connected together.

Foreman—an individual who is responsible for direct supervision of the contractor's workers.

Fossil fuels—non-renewable forms of energy that were formed hundreds of millions of years ago and including coal, oil, and natural gas; carbon is their basic element.

Fracking—the process of injecting water and sand at high pressure into shale rock in order to release gas and oil.

General contractor (GC)—an individual or firm hired by and responsible to an owner for coordinating the completion of a project. The GC hires subcontractors and suppliers.

Geothermal heat pump—a system that uses the earth (and its constant temperature) as a giant heat exchanger; more accurately termed a ground-source heat pump.

Geothermal systems—systems that produce energy using the heat of the earth.

Green—the ability of something to contribute to long-term environmental and social endurance. In construction, sustainability, high-performance, and green are often used interchangeably.

Green Building Initiative—a nonprofit organization that administers professional certification and the Green Globes building assessment and certification in the United States.

Green building materials and products—an imprecise term that describes materials and products that have certain efficiency and other attributes.

Green construction—a process for creating and operating buildings and communities that strives to reduce their environmental impact and maximize social and economic value.

Green documentation—verification that a building and its materials, products, and systems meet green program requirements.

Green Globes—building assessment programs for new and existing buildings, distributed and managed by the Green Building Initiative.

Green infrastructure—the use of vegetation, soils, and systems that mimic natural processes to manage excess runoff, and then infiltrate it into the ground, evaporate it into the air, or slowly discharge it.

Green products—see Green building materials and products.

Green rating systems—programs designed to measure the environmental and social impact of products, systems, and buildings.

Green roof—a roof that is partially or completely covered with vegetation; also called a living roof.

Greenwashing—the practice of misrepresenting or “spinning” the environmental benefits of a product (or structure).

Greywater—wastewater that has not been generated by toilets or urinals.

Ground-source heat pump—a system that uses the earth (and its constant temperature) as a giant heat exchanger for heating and cooling; often inaccurately referred to as a geothermal heat pump.

Health Product Declaration (HPD)—a standard format for reporting product content and associated health information for building products and materials.

Heating and cooling loads—the amount of heating or cooling a building needs; also called “demand.”

Heavy metals—metallic elements such as lead, mercury, and chromium, among others.

High-performance building—a building that optimizes energy efficiency, is durable, meets high-performance standards throughout its life (from the extraction of materials through decommission), and contributes toward occupant productivity. Many sources, including this book, use the terms “green,” “sustainable,” and “high-performance” interchangeably.

Home Energy Rating System (HERS)—a residential energy-use index developed by Residential Energy Services Network (RESNET).

HVAC(R)—heating, ventilating, air conditioning (refrigeration).

Hydropower—systems that use the energy in moving water to do mechanical tasks or to produce electricity.

ICC (International Code Council)—an association that develops coordinated building safety and fire prevention model codes and standards, including the International Green Construction Code (IGCC).

Industrial sector—a sector of the construction industry that includes refineries, electrical stations, chemical processing plants, factories, and similar facilities.

Infill development—the placement of a new development on a previously under-used or abandoned parcel.

Infrastructure—a sector of the construction industry that includes transportation and service projects such as roads, tunnels, ferries, water collection and distribution, and waste management systems that are required to keep our communities functioning.

Insulation—a material or product that prevents the transfer of heat (or sound).

Integrated Project Delivery (IPD)—a project delivery system that is based on a highly collaborative approach to project design and construction.

Interior fit-out—the process of making interior space suitable for use (also called build-out).

Job superintendent—person on a jobsite responsible for coordinating and managing the work. Also called construction superintendent.

Jurisdiction—see Authority having jurisdiction (AHJ).

Kilowatt—a measurement of the rate at which electricity flows (equal to 1,000 watts).

Labor union—an organized group of workers who collectively use their strength to have a voice in their workplace; also called a trade union.

LED light—LEDs, or light-emitting diodes, are semiconductor devices that produce visible light very efficiently when an electrical current passes through them.

LEED (Leadership in Energy and Environmental Design)—a voluntary green building certification program developed by the U.S. Green Building Council and administered by the Green Building Certification Institute that recognizes best-in-class building strategies and practices. LEED includes a suite of green building rating systems as well as professional accreditation.

License—a permit typically issued by a state and required in order to perform certain occupational tasks.

Life-cycle assessment (LCA)—an analysis of the environmental impacts of a product over its entire lifetime.

Life-cycle costing (LCC)—an analysis of costs over the entire life of a product.

Living Building Challenge—building certification programs developed by the International Living Future Institute.

Living roof—a roof that is partially or completely covered with vegetation; also called a green roof.

Load calculations—the process used to determine heating and cooling demand.

Low-E glass—glass with a coating that reflects long-wave heat energy and improves insulating characteristics.

Lump-sum delivery method—a system of organizing a project in which a general contractor is hired on a lump-sum-bid basis after design is complete; also called a traditional/design-bid-build delivery method.

MasterFormat—an organizational tool developed by the Construction Specifications Institute.

Material—a substance that serves as the raw matter from which a product is made (e.g., silicon is a raw material of PV cells); see Products.

MEP—an acronym standing for the mechanical, electrical, and plumbing trades or services.

Merit shop (open shop)—a firm or organization that pays workers according to the laws of the state and federal government and the individual's abilities; workers are not required to be in a union or pay the union dues.

Metered-valve faucets—fixtures that use a predetermined amount of water.

Motion energy—the energy something possesses due to its movement.

NAHB (National Association of Home Builders)—a trade and membership association that helps promote housing policies; developed National Green Building Standards for residential construction.

National Green Building Standard—a point-based rating system for green residential construction, remodeling, and land development developed by the National Association of Home Builders and the International Code Council and ANSI-approved.

Natural ventilation—the process of supplying and removing air through an indoor space by natural means, without the use of a fan or other mechanical system.

Net-metering—the practice of using a single meter to measure consumption and generation of electricity by a small generation facility (such as a house with a wind or solar photovoltaic system); the net energy produced or consumed is, respectively, sold to or purchased from the power provider.

Nontoxic materials and products—those that are not harmful to people and animals.

Off-gassing—the emission of noxious gases, as from building materials.

Operations & Maintenance (O&M) Manual—A manual provided to the owner at the completion of the work that gives critical operation, maintenance, repair, and replacement information.

Orientation—the way a building is situated on a site and the positioning of windows, rooflines, and other features.

Owner—an individual or entity that comes up with a project concept or idea, establishes the time and budget constraints, provides the site, figures out how to pay for the project, and hires many of the people who will help make it happen; owners may be private or public entities.

Performance—the capabilities of something (e.g., a building) under operation. In construction, performance refers to resource use and other building operations and impacts.

PHIUS+—an energy rating system primarily for residential projects, developed by the Passive House Institute US.

Photovoltaic array—a group of solar photovoltaic modules connected together; also called flat plate PV panels.

Photovoltaic panel (also called a flat plate PV panel)—an arrangement of photovoltaic cells mounted on a rigid flat surface with the cells exposed freely to incoming sunlight and a transparent top.

Photovoltaic (PV) systems—systems that use semiconductors to convert the sun's energy directly into electricity.

Photovoltaic (solar) cell—treated semiconductor material that converts solar energy to electricity.

Plug-load—the energy drawn by unregulated appliances and products.

Polyurethane—a manufactured material that comes in different forms and is resilient, flexible, and durable. Polyurethane is found in rigid foam, coatings and paints, adhesives, sealants and elastomers (such as wood sealers and caulks), window treatments, resin flooring, gaskets, and other thermoplastics.

Post-occupancy—the period following construction when a building is used for its intended purpose.

Power—the rate at which energy is produced or consumed; it is measured in watts. See Energy; power and energy are often mistakenly used interchangeably.

Power plant—an installation where electricity is generated for distribution.

Prime contractor—anyone with a direct contract with the owner, typically the general contractor.

Procurement—the process of obtaining goods and services.

Products—goods that are manufactured or refined and typically comprised of raw materials (e.g., PV cells are products that are made, in part, from the raw material silicon). See Materials.

Project—a unique activity that has a beginning and an end, uses resources, is not routinely done, and requires managing.

Project delivery—the organizational structure for completing a project; also called delivery method.

Project manager (PM)—an individual who is typically responsible for the business end of a construction project, in contrast to the job superintendent who is responsible for production.

Radiant energy—the energy that is transmitted by waves, especially electromagnetic waves. Light is a form of radiant energy.

Rainwater harvesting—the process of intercepting rainwater from a roof or other surface and putting it to beneficial use.

Rebound effect—the condition whereby green building performs poorly due to human actions.

Red list—a list of 13 toxic chemicals and materials commonly found in building materials today, which are not allowed in projects seeking certification under the Living Building Challenge.

Renewable energy—fuels that are not diminished when they are used, such as solar, wind, geothermal, and others.

Renewables—energy generated from continually replenishing natural sources.

Residential sector—a sector of the construction industry that includes both new construction and renovation of single- and multi-family properties such as houses, condominiums, and apartments.

R-value—a measure of resistance to heat flow; the higher the R value the greater the insulating value.

Solar farm—multiple solar panels that are grouped together into a single power plant to generate electricity

Solar heat gain—the increase in temperature in a space, object or structure that results from solar radiation.

Smart building—a building that uses technology to integrate its systems to optimize services, costs, and operation.

Smart technology—systems equipped with or using electronic controls.

Solar flat plate thermal collectors—panel systems that use the sun's energy to heat a fluid or air.

Specialty trade contractor—a contractor who is an expert in a specific area of construction.

Specifications—written descriptions of the work that define the materials, the processes, and the quality of products and systems.

Standards—guidelines developed as a way to measure the quality or characteristics of something. Standards may be adopted as mandatory codes.

Stormwater—an abnormal quantity of surface water arising from rain or snow.

Subcontractor—an individual or firm that has a contract with another contractor. In construction, subcontractors are typically specialty trades.

Sustainability—the ability of something to contribute toward long-term environmental and social endurance. In construction, sustainability, high-performance, and green are often used interchangeably.

Systems—in construction, systems are the elements that make up a structure and include the skin (e.g., the roof and exterior walls), the structure (e.g., framing), the heating/cooling/ventilating/lighting assemblies, and the furniture and equipment. Green buildings assume that the systems are integrated with one another in order to optimize efficiency and comfort. See Whole building design.

Thermal bridging—a heat-loss situation that occurs when one area has significantly higher heat transfer capability than the surrounding area.

Thermal energy—energy in the form of heat.

Third-party certifiers—independent product evaluators.

Tight building—a building with an envelope designed to greatly restrict air, heat, and moisture flow from conditioned to unconditioned spaces.

Trade association—an organization founded and funded by businesses that operate in a specific industry.

Trade union—an organized group of workers who collectively use their strength to have a voice in their workplace; also called a labor union.

Traditional delivery method—a general contractor is hired on a lump-sum-bid basis after design is complete. Also called a Design-Bid-Build or Lump-Sum delivery method)

UL (Underwriters Laboratories)—an organization that writes testing standards and certifies products for safety.

U.S. Environmental Protection Agency (EPA)—an agency of the federal government whose mission is to protect human health and the environment.

USGBC (U.S. Green Building Council)—a membership-based nonprofit organization that promotes sustainability in how buildings are designed, built, and operated; developed the LEED rating systems.

Vinyl chloride—a chemical component used primarily to make polyvinyl chloride (PVC) pipes, vinyl siding, vinyl flooring, and other products.

Volatile organic compounds (VOCs)—elements that contain carbon and can vaporize at normal temperatures and enter the air. VOCs lead to the formation of air pollution.

Waste management—the processes of dealing with and controlling construction and demolition debris.

Wastewater—any used water as well as runoff from streets.

Waterless toilets—toilets, including composting toilets and urinals, that use no water.

Wetland—an area that is regularly saturated by surface water or groundwater with vegetation that is adapted to these conditions

WGBC (World Green Building Council)—a worldwide network of green building councils, including the U.S. Green Building Council.

Whole building design—a design approach that analyzes system interdependencies and how they can be leveraged for maximum benefit.

Wind farm—multiple wind turbines that are grouped together into a single power plant.

Wind powered systems—systems that take the kinetic energy present in wind and convert it into mechanical or electric energy.

Zero net energy (ZNE) building—a building that produces, on average, as much energy as it uses.

Zoning ordinances—regulations that determine how a site can be used.