United States Environmental Protection Agency

Green Building

The buildings in which we live, work, and play protect us from nature's extremes, yet they also affect our health and environment in countless ways. As the environmental impact of buildings becomes more apparent, a new field called "green building" is gaining momentum.

Green, or sustainable, building is the practice of creating and using healthier and more resource-efficient models of construction, renovation, operation, maintenance and demolition. Green building is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a building's life-cycle from siting to design, construction, operation, maintenance, renovation and deconstruction. This practice expands and complements the classical building design concerns of economy, utility, durability, and comfort. Green building is also known as a sustainable or high performance building.
Impacts of the built environment:

Aspects of Built Environment:	Consumption:	Environmental Effects:	Ultimate Effects :
• Siting • Design • Construction • Operation • Maintenance • Renovation • Deconstruction	• Energy • Water • Materials • Natural Resources	• Waste • Air pollution • Water pollution • Indoor pollution • Heat islands • Stormwater runoff • Noise	• Harm to Human Health • Environment Degradation • Loss of Resources

Building Types
Homes
Schools
Commercial Buildings
Laboratories
Healthcare Facilities

Frequent Questions about Green Building:

1. What is "green building"?
2. What makes a building "green"?
3. What are the benefits of green building?
4. How is green building related to smart growth and sustainable development?
5. How do buildings affect natural resources?
6. How do buildings affect climate change?
7. What is the history of green building in the U.S.?
8. What building types can be green?
9. Where can I see an example of a green building in my area?
10. How can I incorporate green building concepts into my home?
11. Is there federal or state legislation related to green buildings?
12. What is Life-cycle Assessment?
13. What are the economic benefits of green or sustainable building and development?
14. Are green buildings more expensive to construct and operate?
15. Where can I find sources of funding for my green building project?
16. Can I get a tax break for building green?
17. Where can I find more information about the components of green building, like energy efficiency or reduced waste?"
18. What standards exist for green building?
19. How are buildings certified as green in the U.S.?
20. What is "green building"?

What is "green building"?
Green building - also known as sustainable or high performance building - is the practice of:

1. Increasing the efficiency with which buildings and their sites use and harvest energy, water, and materials; and
2. Protecting and restoring human health and the environment, throughout the building life-cycle: siting, design, construction, operation, maintenance, renovation and deconstruction.

What makes a building "green"?
A green building is a structure that is environmentally responsible and resource-efficient throughout its life-cycle. These objectives expand and complement the classical building design concerns of economy, utility, durability, and comfort.

Green buildings are designed to reduce the overall impact of the built environment on human health and the natural environment by:

Efficiently using energy, water, and other resources
Protecting occupant health and improving employee productivity
Reducing waste, pollution and environment degradation

For example, green buildings may incorporate sustainable materials in their construction (e.g., reused, recycled-content, or made from renewable resources); create healthy indoor environments with minimal pollutants (e.g., reduced product emissions); and/or feature landscaping that reduces water usage (e.g., by using native plants that survive without extra watering).

What are the benefits of green building?
Buildings have an enormous impact on the environment, human health, and the economy. The successful adoption of green building strategies can maximize both the economic and environmental performance of buildings. Specific environmental, economic and social benefits are listed in Why Build Green?

Research continues to identify and clarify all of these benefits and costs of green building, and of how to achieve the greatest benefits at the lowest costs.

How is green building related to smart growth and sustainable development?
Smart growth is development that serves the economy, the community, and the environment by supporting healthy communities while creating economic development and jobs. Sustainability, or sustainable development, is the ability to achieve continuing economic prosperity while protecting the natural systems of the planet and providing a high quality of life for its people.

Green building fits nicely with these concepts, as it promotes building practices that conserve energy and water resources, preserve open spaces through brownfield development, and are accessible to public transportation. EPA has more information on smart growth and sustainability.

How do buildings affect natural resources?
Buildings and development have significant environmental impacts on our natural resources, including:

According to surveys conducted in 2002, 107.3 million acres of the 1.983 billion acres of total land area in the U.S. is developed, which represents an increase of 24 percent in developed land over the past 10 years.
In terms of energy, buildings accounted for 39.4 percent of total U.S. energy consumption and 67.9 percent of total U.S. electricity consumption in 2002.
Building occupants use 12.2 percent of the total water consumed in the U.S. per day.
Buildings, and the transportation infrastructure that serves them, replace natural surfaces with impermeable materials, creating runoff that washes pollutants and sediments into surface waters. Urban runoff constitutes a major threat to water resources, as it has been identified as the fourth leading source of impairment in rivers, third in lakes, and second on estuaries.

How do buildings affect climate change?
The energy used to heat and power our buildings leads to the consumption of large amounts of energy, mainly from burning fossil fuels - oil, natural gas and coal - which generate significant amounts of carbon dioxide (CO2), the most widespread greenhouse gas. Buildings in the U.S. contribute 38.1 percent of the nation's total carbon dioxide emissions.

Reducing the energy use and greenhouse gas emissions produced by buildings is therefore fundamental to the effort to slow the pace of global climate change. Buildings may be associated with the release of greenhouse gases in other ways, for example, construction and demolition debris that degrades in landfills may generate methane, and the extraction and manufacturing of building materials may also generate greenhouse gas emissions. More information is available on EPA's Climate Change Website.

What is the history of green building in the U.S.?

Some practices, such as using local and renewable materials or passive solar design, date back millennia – the Anasazi in the Southwest built entire villages so that all the homes received solar heat in the winter. The contemporary green building movement arose out of the need and desire for more energy efficient and environmentally friendly building practices. The oil price increases of the 1970s spurred significant research and activity to improve energy efficiency and find renewable energy sources. This, combined with the environmental movement of the 1960s and 1970s, led to the earliest experiments with contemporary green building.
The green building field began to come together more formally in the 1990s. A few early milestones in the U.S. include:

~American Institute of Architects (AIA) formed the Committee on the Environment Exit Disclaimer (1989)
~EPA and the U.S. Department of Energy launched the ENERGY STAR program (1992)
~ “Greening of the White House" initiative launched (Clinton Administration 1993)
~ USGBC launched their Leadership in Energy and Environmental Design (LEED) pilot program (1998)
~ President Bush signs Executive Order 13423 - Strengthening Federal Environmental, Energy, and Transportation Management , which includes federal goals for sustainable design and high performance buildings (2007)

What building types can be green?
Any type of building has the potential to become a green or sustainable building, however every building type has different design and efficiency needs depending on its particular function. New buildings may be designed, built and operated to be green buildings. Existing building can also become green through remodeling, retrofitting and improved operations.

Where can I see an example of a green building in my area?

Green buildings are being constructed all over the globe. You can search for green buildings in your area in the U.S. Department of Energy's High Performance Buildings Database.

Two of the most commonly used green building rating systems in the United States are the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) and the Green Building Initiative's (GBI) Green Globes. USGBC maintains a database of LEED-registered or certified building projects Exit Disclaimer. GBI provides case studies of Green Globe rated projects Exit Disclaimer.

How can I incorporate green building concepts into my home?
EPA provides a list of programs that can help you incorporate green building concepts into your home.

The Public-Private Partnership for Advancing Housing Technology also maintains a list of regional Green Building Certification Programs for housing Exit Disclaimer.

Is there federal or state legislation related to green buildings?
On the federal level, the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007 included energy efficiency and sustainable design requirements for Federal and other buildings. Additionally, there have been a series of Executive Orders and agency-specific rules promoting green building since the early 1990s and the federal government has instituted sustainable practices at many of its buildings. The Federal Commitment to Green Building: Experiences and Expectations is a report of the Office of the Federal Environmental Executive, provides a history of these rules and the greening of federal facilities.

The Library of Congress THOMAS Web site has the most current information about federal legislation. Search Bill Text for "green building" to find relevant legislation.

Many state and local governments also have green building laws, mainly applying to public buildings, though an increasing number are applicable to private buildings as well. Two third-party organizations maintain lists of green building legislation:

~ American Institute of Architects' State Legislation Tracking
~ U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) Initiatives in Government and Schools

What is Life-cycle Assessment?
Life-cycle assessment (LCA) is the science of measuring the environmental effects of a building "from cradle to grave," from the harvesting and extraction of the materials used to make the building to its ultimate disposal.

What are the economic benefits of green or sustainable building and development?
Well-designed, constructed, operated and maintained green buildings can have many benefits, including durability; reduced costs for energy, water, operations and maintenance; improved occupant health and productivity; and the potential for greater occupant satisfaction than standard developments.

A green building may cost more up front, but can save money over the life of the building through lower operating costs. These savings may be more apparent through life-cycle assessment (LCA).

Cost savings are most likely to be fully realized when incorporated at the project's conceptual design phase with the assistance of an integrated team of building professionals. The integrated systems approach aims to design the building as one system rather than a collection of potentially disconnected systems.

Are green buildings more expensive to construct and operate?
Perhaps surprisingly, good green buildings often cost only a few percentage points or no more to build than conventional designs. Integrated design processes that identify the most efficient, holistic approaches to building green can reduce these initial costs. For example, in some cases, when buildings are carefully designed to be energy efficient, heating/ventilation/air conditioning (HVAC) equipment can be downsized for significant savings. There are also many green products and materials that cost the same or even less than conventional ones.

The General Services Administration (GSA) did a cost study evaluating the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) standards, estimating the cost to develop "green" federal facilities. The study looks at two types of buildings (a courthouse and office building) and the costs associated with renovating each to the three different LEED levels: gold, silver and certified. More information is available in the final report: GSA LEED Cost Study

Where can I find sources of funding for my green building project?
EPA has developed a list of funding opportunities for green building on the national, state, and local levels for homeowners, industry, government organizations, and nonprofits.

Can I get a tax break for building green?
There are some federal tax credits for specific energy efficiency projects in buildings. More and more states are beginning to introduce and pass legislation establishing green building tax benefits, including New York and Maryland.

Where can I find more information about the components of green building, like energy efficiency or reduced waste?
Please see the *http://www.epa.gov/greenbuilding/pubs/components.htm "Components of Green Building"* Web page for links to EPA programs addressing energy efficiency and renewable energy, water efficiency, environmentally preferable building materials and specifications, waste reduction, toxics reduction, indoor air quality and smart growth and sustainable development.

What standards exist for green building?
Several voluntary consensus-based standards organizations are developing standards for green buildings, including:

> *~ASTM International's Technical Subcommittee E06.71 on Sustainability and Performance of Buildings has developed several green building standards*
> *~The American Society for Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) is partnering with the U.S. Green Building Council (USGBC) and Illuminating Engineering Society of North American (IESNA) to develop Standard 189, Standard for the Design of High-Performance Green Buildings Except Low-Rise Residential Buildings.*

How are buildings certified as green in the U.S.?
EPA does not have a green building certification program. However, EPA and the U.S. Department of Energy's ENERGY STAR® addresses one of the most important aspects of green building, energy. ENERGY STAR qualifies new and renovated buildings as energy efficient, and awards the ENERGY STAR label.

However if a building in the United States wants to be considered "Green", a private and non-profit green building certification program called Leadership in Energy and Environmental Design (LEED) is the most common certification sought after. A building seeks to receive "points" based on certain requirements. The highest rating a building can receive is a "LEED Certified Platinum Level"

Information from http://www.epa.gov/greenbuilding/index.htm