



The Built Environment

built environment refers to the man-made surroundings that provide the setting for human activity, ranging in scale from buildings and parks or green space to neighborhoods and cities that can often include their supporting infrastructure, such as water supply or energy networks.

Why is green building necessary?

Buildings and communities, including the resources used to create them and the energy, water, and materials needed to operate them, have a significant effect on the environment and human health.

In the United States, buildings account for:

- 14% of potable water consumption!
- 30% of waste output
- 40% of raw materials use
- 38% of carbon dioxide emissions
- 24% to 50% of energy use
- 72% of electricity consumption

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THE CUMULATIVE EFFECT OF CONVENTIONAL PRACTICES IN THE BUILDING INDUSTRY HAS PROFOUND IMPLICATIONS FOR HUMAN HEALTH, THE ENVIRONMENT, AND THE ECONOMY:

- Clearing of land for development often destroys wildlife habitat
- Extracting, manufacturing, and transporting materials may pollute water and air, release toxic chemicals, and emit greenhouse gases
- Building operations require large inputs of energy and water and generate substantial waste streams
- Transportation to and from buildings by commuters and service providers compounds the harmful environmental effects associated with vehicle use, such as increased energy consumption and pollution



New Buildings Institute

A study by the New Buildings Institute found that in green buildings, average energy use intensities (energy consumed per unit of floor space) are 24% lower than in typical buildings.

ENERGY USE INTENSITY (kBtu/sf/yr)



WHAT IS GREEN BUILDING?

Green building is a process that applies to:

Buildings

Sites

Interiors

Operations

Communities



WHAT IS GREEN BUILDING?

Triple Bottom Line

- **PEOPLE (SOCIAL CAPITAL).** All the costs and benefits to the people who design, construct, live in, work in, and constitute the local community and are influenced, directly or indirectly, by a project
- **PLANET (NATURAL CAPITAL).** All the costs and benefits of a project on the natural environment, locally and globally
- **PROFIT (ECONOMIC CAPITAL).** All the economic costs and benefits of a project for all the stakeholders (not just the project owner)



WHAT IS GREEN BUILDING?

U.S. Environmental Protection Agency (EPA)

Found that people in the United States spend, on average, 90% of their time indoors.

	Week	1	2	3
COUCH POTATO TO 5K				
	1	60 sec run 90 sec walk Repeat 8 times	60 sec run 90 sec walk Repeat 8 times	60 sec run 90 sec walk Repeat 8 times
	2	90 sec run 2 min walk Repeat 6 times	90 sec run 2 min walk Repeat 6 times	90 sec run 2 min walk Repeat 6 times
WARM UP 5-min brisk walk	3	90 sec run 60 sec walking 3 min run 2 min walk Repeat 3 times	90 sec run 60 sec walking 3 min run 2 min walk Repeat 3 times	90 sec run 60 sec walking 3 min run 2 min walk Repeat 3 times
COOL DOWN 3 - 10 min walk & stretch	4	4 min run 2 min walk 4 min run 60 sec walk Repeat 2 times	5 min run 2 min walk 5 min run 90 sec walk Repeat 2 times	6 min run 3 min walk 5 min run 90 sec walk Repeat 2 times
REST DAYS 1-2 full rest days each week. Use days in between for strength training, yoga etc.	5	8 min run 5 min walk 8 min run	8 min run 3 min walk 8 min run	10 min run 5 min walk 8 min run
	6	10 min run 5 min walk 10 min run	10 min run 3 min walk 10 min run	12 min run 3 min walk 10 min run
<i>Go to FitBodyHQ.com for a printable version of this workout.</i>	7	15 min run 3 min walk 10 min run		22 min run
	8	25 min run	26 min run	27 min run
	9	28 min run	29 min run	30 min run

WHAT IS GREEN BUILDING?

Indoor Air Quality in Offices and Other Large Buildings

- Many office buildings have significant air pollution sources.
- Inadequately ventilated.
- Mechanical ventilation systems may not be designed or operated to provide adequate amounts of outdoor air.
- People generally have less control over the indoor environment in their offices than they do in their homes. As a result, there has been an increase in the incidence of reported health problems.

WHAT IS GREEN BUILDING?

Green Buildings are Healthier

Occupants of green buildings are typically exposed to far lower levels of indoor pollutants and have significantly greater satisfaction with air quality and lighting than occupants of conventional buildings.

Research conducted at Carnegie Mellon University shows that these benefits can translate into a **2% to 16% increase in workers' and students' productivity.**

Even small increases in productivity can dramatically increase the value of a building.

THE RISE OF THE GREEN BUILDING INDUSTRY

USGBC Mission

“to transform the way buildings and communities are designed, built and operated, enabling an environmentally and socially responsible, healthy, and prosperous environment that improves the quality of life.”



THE RISE OF THE GREEN BUILDING INDUSTRY

USGBC Programs

Education programs

Advocacy

Research

Community - Network of local chapters

GreenBuild International Conference and Expo

LEED Green Building Program

The Goal of LEED is Market Transformation—

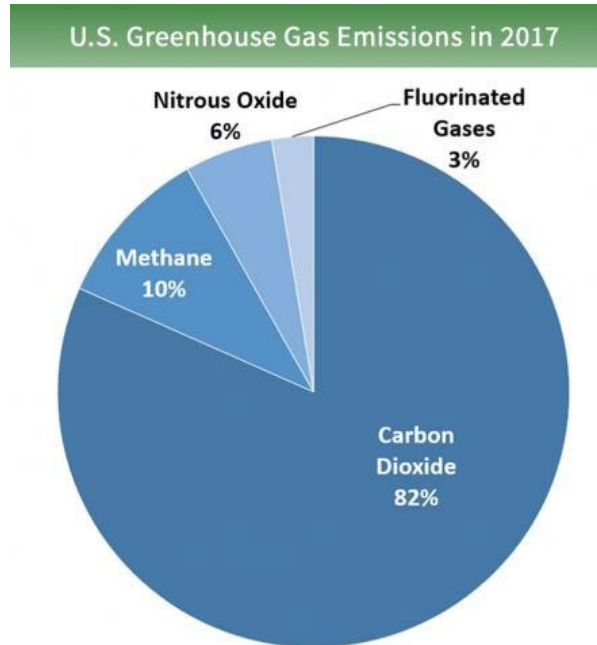
To fundamentally change how we design, build, and operate buildings and communities—through certification that honors levels of achievement in areas such as:

- Energy Savings
- Water Efficiency
- CO₂ Emissions Reduction
- Improved Indoor Environmental Quality
- Stewardship of Resources

THE RISE OF THE GREEN BUILDING INDUSTRY

Green House Gas (GHG)

The built environment, including buildings and transportation systems, accounts for more than two-thirds of all greenhouse gas emissions.



<https://www.epa.gov/ghgemissions/overview-greenhouse-gases>

Where Do GHG Emissions Come From?

- Building systems and energy use
- Transportation
- Water use and treatment
- Landcover change
- Materials
- Construction

By improving the efficiency of buildings and communities, we can significantly reduce greenhouse gas emissions.

ENERGY CONSUMPTION: BUILDING-ASSOCIATED TRANSPORTATION VERSUS OPERATIONS

For an average office building in the United States, 30 percent more energy is expended by office workers commuting to and from the building than is consumed by the building itself for heating, cooling, lighting, and other energy uses. Even for an office building built to modern energy codes (ASHRAE 90.1-2010), more than twice as much energy is used by commuters than by the building.¹⁰

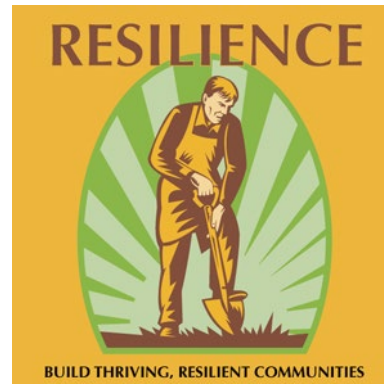
GREEN BUILDING OVER TIME

Green Projects

Continuous Monitoring - Identify Needed Improvements

Adapt to Changes - Build in [Resilience](#)

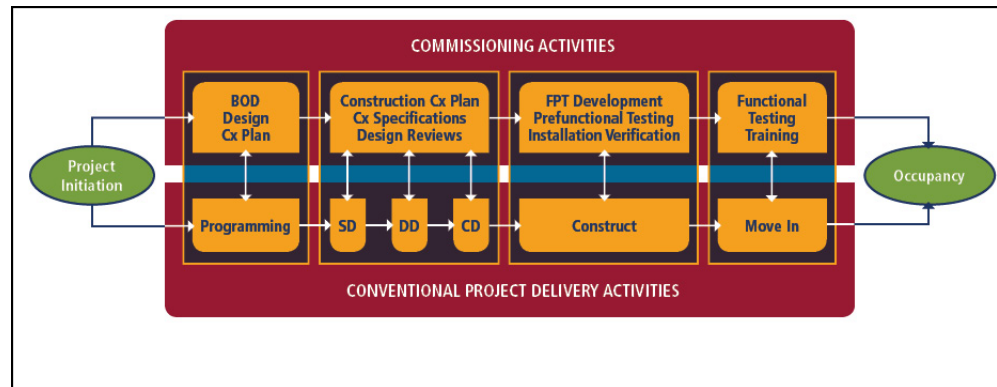
Maintain the Buildings Performance at the Highest Level



GREEN BUILDING OVER TIME

Commissioning

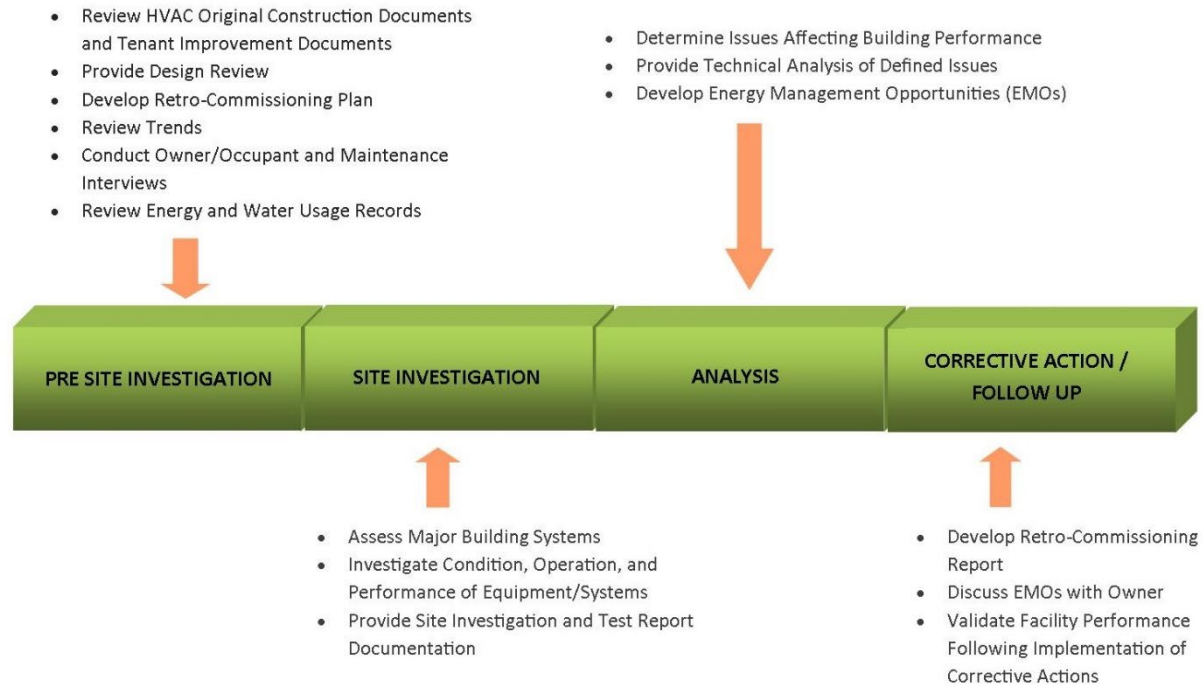
Process of verifying and documenting that a building and all its systems and assemblies are planned, designed, installed, tested, operated, and maintained to meet the owner's project requirements.



Retrocommissioning

A tune-up that identifies inefficiencies and restores high levels of performance.

RETRO-COMMISSIONING PROCESS OVERVIEW



GREEN BUILDING OVER TIME

Adaptive Reuse

Adaptive reuse is the practice of redesigning and using a structure for a use that is significantly different from the building's original use.

- Reduces** the need for extracting materials for a new building and disposing of demolition waste.
- Reuses** a site that is already served by infrastructure and avoids the conversion of farmland or forest to development.



Community Issues

- Access to site by mass transit and pedestrian or bicycle paths.
 - Availability of public transportation is essential for reducing carbon emissions.
 - Bicycling and walking, depend on the proximity of destinations, connectivity of the community, and design of surroundings.
 - Roads that are designed for only motor vehicles do not provide the flexibility or adaptability of a transportation network designed for diverse travel modes.

Community Issues

- Attention to culture and history of community
 - Buildings that protect the history and character of a place also promote sustainability.
 - A project team can take advantage of the community's past by reusing materials with historic value.
 - Linking the present with the past reinforces a sense of place and helps create attractive communities with viable commercial centers.
 - Sustainable design ensures that buildings and communities will survive and thrive for generations, no matter what the future holds.

Community Issues

- Climatic characteristics as they affect design of building or building materials
- Local incentives, policies, regulations that promote green design
- Infrastructure in community to handle demolition waste recycling
- Regional availability of environmental products and expertise

Location

- **NATURAL CONTEXT.** Climate, sun, wind, orientation, soils, precipitation, local flora and fauna.
- **INFRASTRUCTURAL CONTEXT.** Available resources, materials, skills, and connections to utilities, roads and transit.
- **SOCIAL CONTEXT.** Connections to the community and other destinations, local priorities, cultural history and traditions, local regulations and incentives.

Selecting a location is one of the earliest decisions made in a project, and this decision defines many of the opportunities and constraints that the project team will encounter.

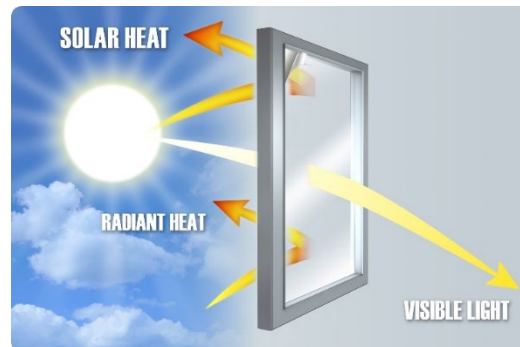
It can determine whether a project can take advantage of sunlight, have access to public transportation and other services, and protect habitats.

GREEN BUILDING COSTS AND SAVINGS

Design

Green building should be integrated into the design process as early as possible.

Example: Specification of more costly, high-performance windows may allow for the use of a smaller, lower-cost heating, ventilation, and air-conditioning (HVAC) system.



GREEN BUILDING COSTS AND SAVINGS

Green Buildings

A landmark study by the firm Davis Langdon found no significant difference between the average cost of a LEED-certified building and other new construction in the same category: there are expensive green buildings, and there are expensive conventional buildings.

Certification as a green building was not a significant indicator of construction cost.



Green Buildings Go Beyond Net Zero

Designing buildings that produce more power than they consume.

By Brenda Poppy | Thursday, May 28, 2015

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The Bullitt Center is one of the greenest buildings in the world. The office building, which opened on Earth Day, April 22, 2013, generates 60 percent more power than it uses and harvests rainwater to feed bathroom taps. Its parking garage houses only bikes.

Benjamin Benschneider, courtesy of the Bullitt Center

GREEN BUILDING COSTS AND SAVINGS

A 2007 public opinion survey conducted by **World Business Council for Sustainable Development** found that respondents believed, on average, that green features added 17% to the cost of a building, whereas a study of 146 green buildings found an actual average marginal cost of **less than 2%**.

Green building - significant predictor of tangible improvements in building performance, and those improvements have considerable value.

Studies have shown that certified green buildings command significantly higher rents.

GREEN BUILDING COSTS AND SAVINGS

A **University of California–Berkeley** study analyzed 694 certified green buildings and compared them with 7,489 other office buildings, each located within a quarter-mile of a green building in the sample.

The researchers found that, on average, certified green office buildings rented for **2% more** than comparable nearby buildings.

After adjusting for occupancy levels, they identified a 6% premium for certified buildings. The researchers calculated that at prevailing capitalization rates, this adds more than \$5 million to the market value of each property.

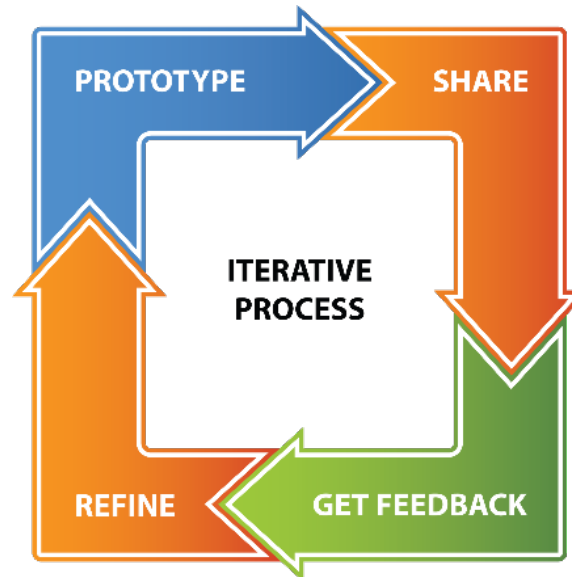
Regenerative Design

- Support the health of the local community and regional ecosystems
- Generate electricity and send the excess to the grid
- Return water to the hydrologic system cleaner
- Serve as locations for food production and community networking
- Regenerate biodiversity

Promote many other relationships that link the projects to the whole system of life around them.

Green Building Process

- ❑ Requires new skills and new knowledge, as well as new attitudes and new mindsets.
- ❑ The green building process is interdisciplinary, iterative, and collaborative.



Teamwork

Teamwork and critical thinking are valued.

TEAMWORK

coming together is a beginning
keeping together is progress
working together is success

- Henry Ford