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GA01 LEED Core Concepts Guide – Section 1. Introduction to Green Building s and Communities

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.

THE ENVIRONMENTAL IMPACTS OF BUILDINGS

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

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 - http://newbuildings.org/
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)

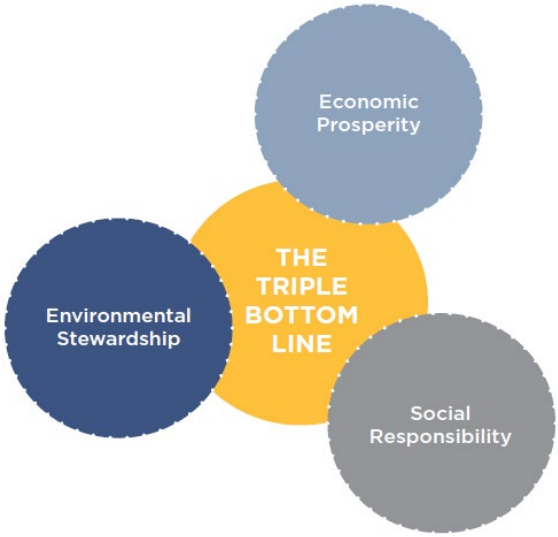
WHAT IS GREEN BUILDING?

Green Building
Green building is a process that applies to:
Buildings
Sites
Interiors
Operations
Communities

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)



U.S. Environmental Protection Agency (EPA)
Found that people in the United States spend, on average, 90% of their time indoors.

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.

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."

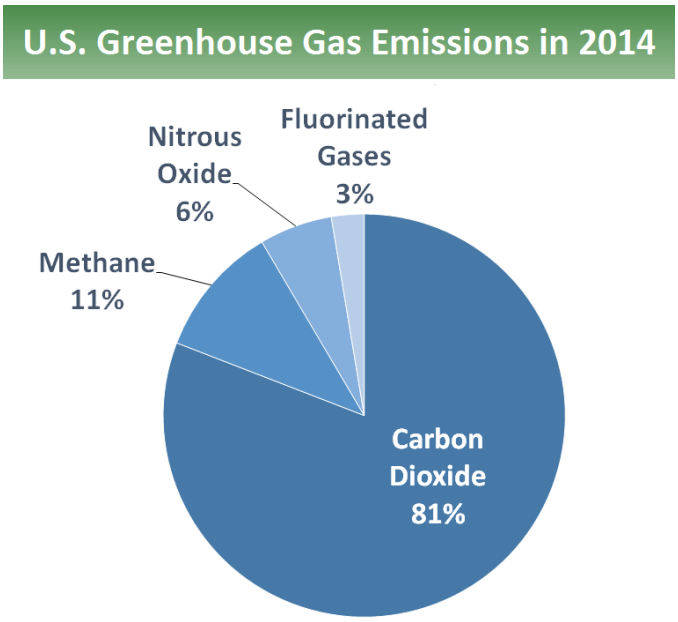
USGBC Programs
Education programs
Advocacy
Research
Community - Network of local chapters
GreenBuild International Conference and Expo
LEED Green Building Program

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

GREEN BUILDING AND CLIMATE CHANGE

Green House Gas (GHG)
The built environment, including buildings and transportation systems, accounts for more than two-thirds of all greenhouse gas emissions.



U.S. Environmental Protection Agency (2014).
U.S. Greenhouse Gas Inventory Report: 1990-2014.

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

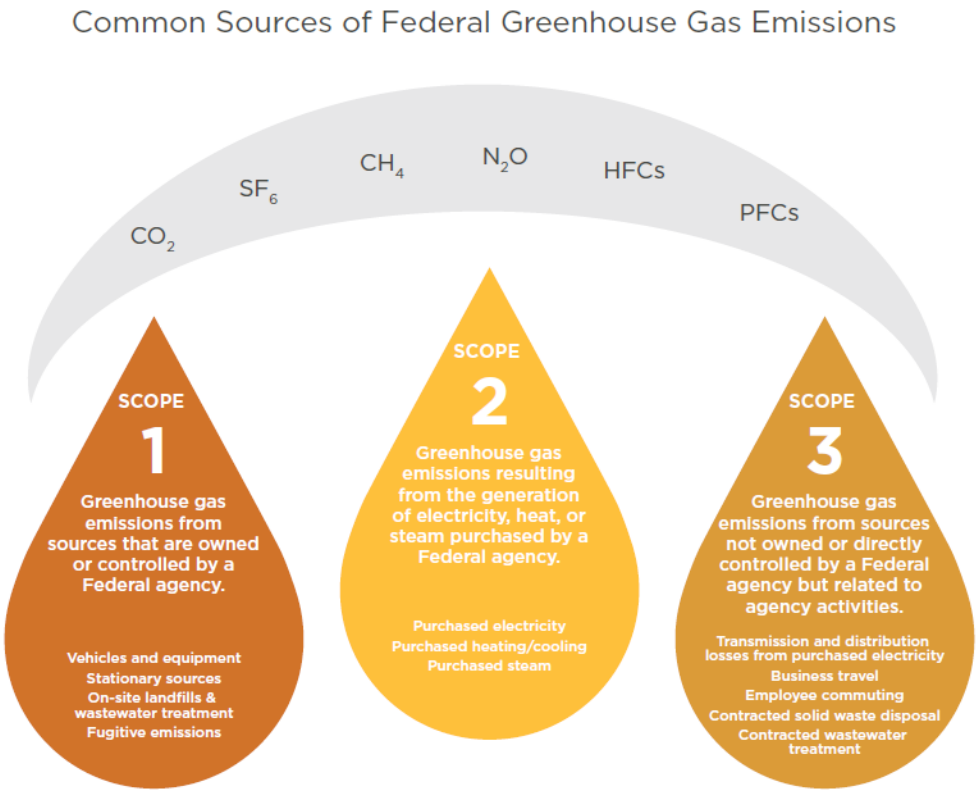


Figure 1.3. Common Sources of Greenhouse Gas Emissions from Federal Facilities as Called Out by Executive Order 13514.

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

Figure 1.4. Building Location without Supporting Infrastructure and Services

Figure 1.5. Building Location with Infrastructure and Services

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

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.

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

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.
- ❑ 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.
- ❑ 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

GREEN BUILDING AND LOCATION

Location - a critical element of a Green Building
Location includes these factors:

- **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.

passive design
planning with the intent of capturing sunlight, wind or other natural forces for light, heating, and cooling.

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

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 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.

A 2007 public opinion survey conducted by the **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.

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.

BEYOND GREEN

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 EXPERTISE

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.

Green buildings

- ✓ Save energy
- ✓ Use less water
- ✓ Generate less waste
- ✓ Provide more healthful, more comfortable indoor environments