## What is a "Green" Building?

**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 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. The term “Green Building” is often used in combination with “high-performance building”, “sustainable design” and “preserving precious resources”.

## Importance of Green Building

The related concepts of sustainable development and sustainability are integral to green building. Effective green building can lead to

1. Reduced operating costs by increasing productivity and using less energy and water

2. Improved public and occupant health due to improved indoor air quality

3. Reduced environmental impacts by, for example,reducing storm water runoff and the heating effect.

Practitioners of green building often seek to achieve not only ecological but aesthetic harmony between a structure and it’s surrounding of natural and built environment. The appearance and style of sustainable homes and buildings can be nearly indistinguishable from their less sustainable counterparts.

An increasing number of authorities, organizations and institutions are working on raising consciousness about “Green Building”. It is increasingly governed and driven by standards, such as the Leadership in Energy and Environmental Design (LEED) rating system in U.S. as well as The Energy and Resource Institute (TERI).

According to the CII, India - “Green” is regarded as ‘The voluntary pursuit of any activity which is concerned with energy efficiency, environmental management, water management, renewable energy, and waste management and recycling.’ Green practices ultimately leading to sustainable development and equitable growth

## BENEFITS OF GREEN BUILDING:

Choosing a green building for a home is not just an option but a lifelong commitment to uphold the virtues of natural, sustainable living...a conscious decision to arrest resource depletion and protect nature for our future generations.

### Environmental benefits

- Enhance and protect biodiversity and ecosystems
- Improve air and water quality
- Reduce waste streams
- Conserve and restore natural resources
- Better indoor air quality (IAQ has a tremendous impact on human health)

### Economic benefits

- Reduce operating costs
- Create, expand, and shape markets for green product and services
- Improve occupant productivity
- Optimize life-cycle economic performance

### Social benefits

- Enhance occupant comfort and health
- Heighten aesthetic qualities
- Minimize strain on local infrastructure
- Improve overall quality of life

## FUNDAMENTAL PRINCIPLES OF GREEN BUILDING

Are you aware that your office or residential building could be harming the environment? Is it possible that your building is spewing harmful pollutants without you realizing it? We are well aware of various environmental issues such as global warming, water and air pollution and the measures that need to be taken to prevent them. If we switch to sustainable architecture and green buildings in India, not just for nature's sake, but for ourselves, we could not only save the environment but also reduce our total ownership costs.

The building construction industry produces the second largest amount of demolition waste and greenhouse gases (35-40%). The major consumption of energy in buildings is during construction and later in lighting or air-conditioning systems. While, various amenities like lighting, air conditioning, water heating provide comfort to building occupants, but also consume an enormous

amount of energy and add to pollution. Further, occupant activities generate a large amount of solid and water waste as well.

Sustainable architecture is the type of architecture that seeks to minimize the harmful impact that buildings have on the environment. Such sustainably built green buildings are environmentally responsible and resource-efficient, right from location selection to the demolition after its lifecycle ends. A green building uses less energy, water and other natural resources creates less waste and greenhouse gases and is healthy for people living or working inside as compared to a regular structure.

Building green is not about a little more efficiency. It is about creating buildings that optimize on the use of local materials, local ecology and most importantly they are built to reduce power, water and material requirements. Thus, if these things are kept in mind, then we will realize that our traditional architecture was in fact, very green. According to TERI estimates, if all buildings in Indian urban areas were made to adopt green building concepts, India could save more than 8,400 megawatts of power, which is enough to light 550,000 homes a year. There are five fundamental principles of Green Building:

**1. Sustainable Site Design**

- Create minimum urban sprawl and prevent the needless destruction of valuable land, habitat and open space
- Encourage higher density urban development as a means to preserve valuable green space
- Preserve key environmental assets through careful examination of each site

**2. Water Quality & Conservation**

- Preserve the existing natural water cycle and design the site so that they closely emulate the site's natural hydrological systems
- Emphasis on retention of stormwater and on-site infiltration as well as ground water recharging
- Minimize the inefficient use of potable water on the site while maximizing the recycling and reuse of water, including rainwater harvesting, stormwater, and grey water.

**3. Energy & Environment**

- Minimize adverse impact on the environment through optimized building siting & design, material selection, and aggressive use of energy conservation measures
- Maximize the use of renewable energy and other low impact energy sources
- Building performance should exceed minimum International Energy Code (IEC) compliance level by 30-40%.

**4. Indoor Environmental Quality**

- Provide a healthy, comfortable and productive indoor environment for building occupants
- Utilize the best possible conditions in terms of indoor air quality, ventilation, and thermal comfort, access to natural ventilation and day lighting

**5. Materials and Resources**

- Minimize the use of non-renewable construction materials and other resources such as energy and water through efficient engineering, design, planning and construction and effective recycling of construction debris.
- Maximize the use of recycled content materials, modern resource efficient engineered materials, and resource efficient composite type structural systems wherever possible.
- Maximize the use of re-usable, renewable, sustainably managed, bio-based materials. Remember that human creativity and our abundant labor force is perhaps our most valuable renewable resource. The best solution is not necessarily the one that requires the least amount of physical work.

  **Key Strategies and Technologies:**

  • Optimize the use of engineered materials which make use of proven engineering principles such as engineered trusses, composite materials and structural systems (concrete/steel, other…), structural insulated panels (stress skin panels), insulated concrete forms, and frost protected shallow foundations which have been proven to provide high strength and durability with the least amount of material.

  • Identify ways to use high-recycled content materials in the building structure and finishes. Consider everything from blended concrete using fly ash, slag, recycled concrete aggregate, or other admixtures to recycled content materials such as structural steel, ceiling and floor tiles, carpeting, carpet padding, sheathing, and gypsum wallboard.

  • Explore the use of bio-based materials and finishes such as various types of agriboard. Some structural insulated panels are now made from bio-based materials. Use lumber and wood products from certified forests where the forest is managed and lumber is harvested using sustainable practices.

  • Evaluate all products and systems used for their ability to be recycled when they reach the end of their useful life. Preference should be given to products and systems that facilitate easy, non-energy intensive separation and recycling with minimal contamination by foreign debris.

  • Recognize that transportation becomes part of a product or building materials embodied energy. Where practical, specify and use locally harvested, mined and manufactured materials and products to support the regional economy and to reduce transportation, energy use and emissions.

**WATER EFFICIENCY**

Reducing water consumption and protecting water quality are key objectives in sustainable building. One critical issue of water consumption is that in many areas, the demands on the supplying aquifer exceed its ability to replenish itself. To the maximum extent feasible, facilities should increase their dependence on water that is collected, used, purified, and reused on-site. The protection and conservation of water throughout the life of a building may be accomplished by designing for dual plumbing that recycles water in toilet flushing or by using water for washing of the cars. Waste-water may be minimized by utilizing water conserving fixtures such as ultra-low flush toilets and low-flow shower heads. Bidets help eliminate the use of toilet paper, reducing sewer traffic and increasing possibilities of re-using water on-site. Point of use water treatment and heating improves both water quality and energy efficiency while reducing the amount of water in circulation. The use of non-sewage and greywater for on-site use such as site-irrigation will minimize demands on the local aquifer.

Large commercial buildings with water and energy efficiency can qualify for an LEED Certification. Philadelphia's Comcast Center is the tallest building in Philadelphia. It's also one of the tallest buildings in the USA that is LEED Certified. Their environmental engineering consists of a hybrid central chilled water system which cools floor-by-floor with steam instead of water.

## Energy efficiency

An eco-house at Findhorn Ecovillage with a turf roof and solar panels

Green buildings often include measures to reduce energy consumption – both the embodied energy required to extract, process, transport and install building materials and operating energy to provide services such as heating and power for equipment.

As high-performance buildings use less operating energy, embodied energy has assumed much greater importance – and may make up as much as 30% of the overall life cycle energy consumption. Studies such as the U.S. LCI Database Project show buildings built primarily with wood will have a lower embodied energy than those built primarily with brick, concrete, or steel.

To reduce operating energy use, designers use details that reduce air leakage through the building envelope (the barrier between conditioned and unconditioned space). They also specify high-performance windows and extra insulation in walls, ceilings, and floors. Another strategy, passive solar building design, is often implemented in low-energy homes. Designers orient windows and walls and place awnings, porches, and trees to shade windows and roofs during the summer while maximizing solar gain in the winter. In addition, effective window placement (daylighting) can provide more natural light and lessen the need for electric lighting during the day. Solar water heating further reduces energy costs.

Onsite generation of renewable energy through solar power, wind power, hydro power, or biomass can significantly reduce the environmental impact of the building. Power generation is generally the most expensive feature to add to a building.

Energy efficiency for green buildings can be evaluated from either numerical or non-numerical methods. These include use of simulation modeling, analytical or statistical tools.

The location where the green building is indented to be constructed and the environment surround the location play an important role in the overall sustainability of the green building.

## SUSTAINABLE SITE SELECTION:

The site that is selected for the construction not only must satisfy the building project but also the municipality under which the site is constructed. This means that, a building in the site must be constructed such a way that the surrounding natural environment and the related ecosystem is not affected in any means.

While conducting the procedures for site selection, the surrounding waterways, nearby farmland and protected wetlands must be taken as main considerations in the decision.

Leadership in Energy and Environmental Design (LEED) is a certification that is provided for buildings with green qualities and sustainability.