

CMTI INTERNSHIP ASSIGNMENT ON GREEN BUILDINGS

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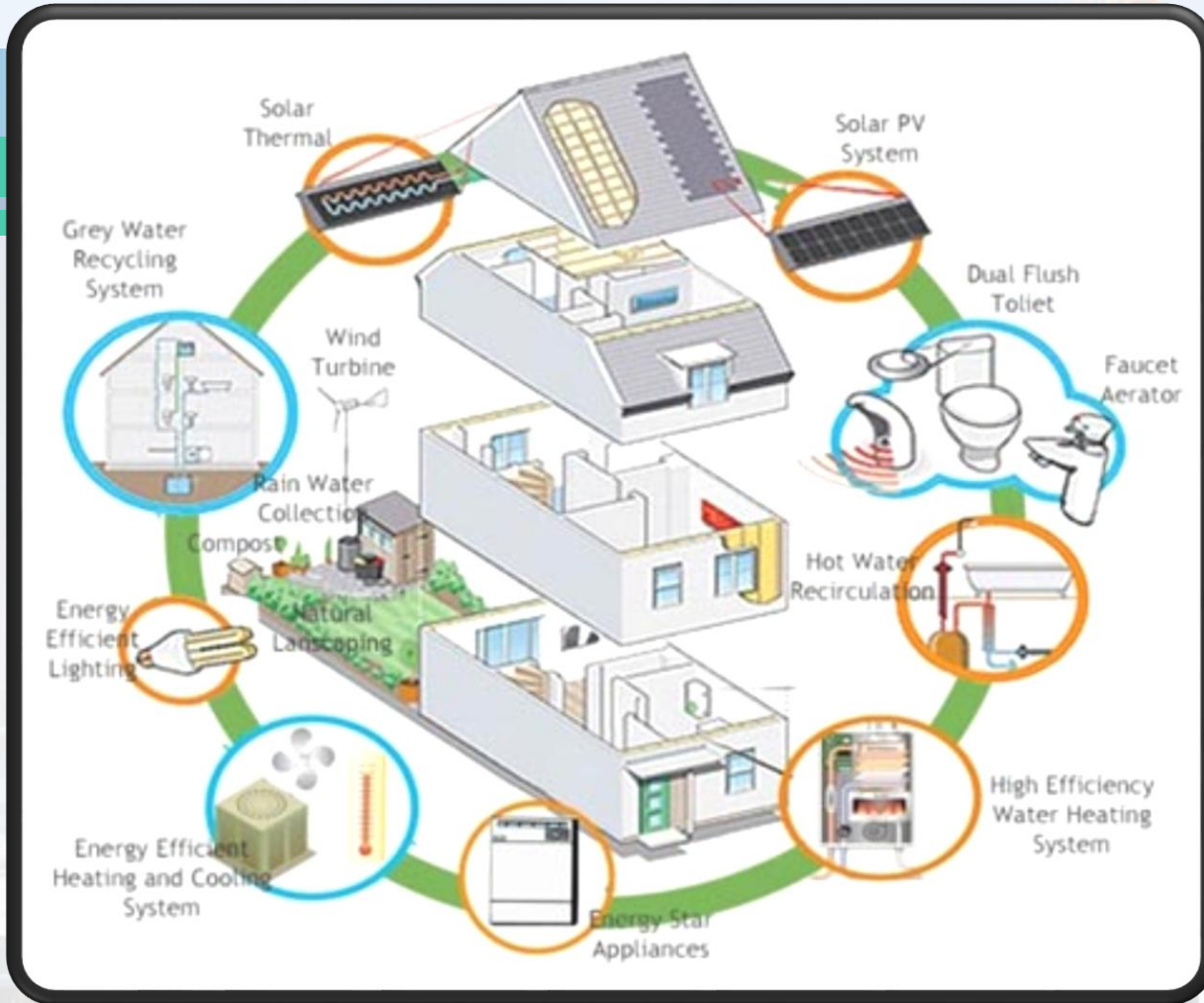
INTRODUCTION

What is Green Building?

A green building is one whose construction and lifetime of operation assure the healthiest possible environment while representing the most efficient and least disruptive use of land, water, energy and resources.

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.’

- Blending right mix of green technologies
- For example, the use of high performance windows and window frames increases the first cost of the building envelope, however the resulting reduction in the size and cost of the buildings heating and cooling system more than offsets the added cost of the better glazing system. The result is a building that has a comparable or perhaps even a lower first cost, a higher comfort level, lower energy use, and lower energy bills and operating cost for the life of the building.



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IMPORTANCE

Why Green Building?

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

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. Therefore,

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.

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How to adopt Green Building technology?



In practical terms, green building is a whole-systems-approach to building that includes:

- Designing for livable communities
- Using sun and site to the building's advantage for natural heating, cooling, and daylighting
- Landscaping with native, drought-resistant plants and water-efficient practices
- Building quality, durable structures
- Reducing and recycling construction and demolition waste
- Insulating well and ventilating appropriately
- Incorporating durable, salvaged, recycled, and sustainably harvested materials
- Using healthy products and building practices
- Using energy-efficient and water-saving appliances, fixtures and technologies

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FUNDAMENTAL PRINCIPLES

5 BASIC PRINCIPLES OF A GREEN BUILDING

Sustainable
Site Design



#1



#2

Water Conservation
and Quality



Energy and
Environment



#3



#4

Conservation of resources
& reuse of materials



Indoor Environmental
Quality



#5

By- Wienerberger.in

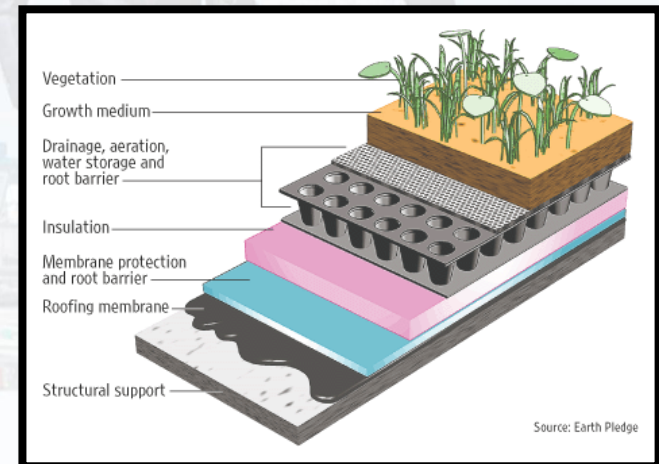
• Sustainable Site Design

The location where the Green Building is intended to be constructed and the environment surrounding the construction play an important role in the overall sustainability of the Green Building.



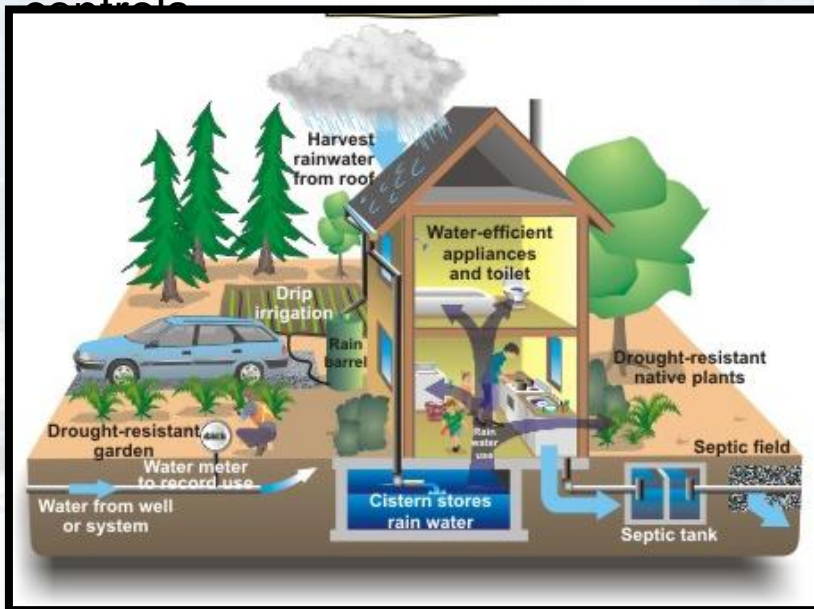
Parameters involved

- Impact on the environment
- Connection with the community
- New development is limited
- Transportation
- Public amenities and availability
- Utilizing open spaces
- Storm water control
- Heat land reduction

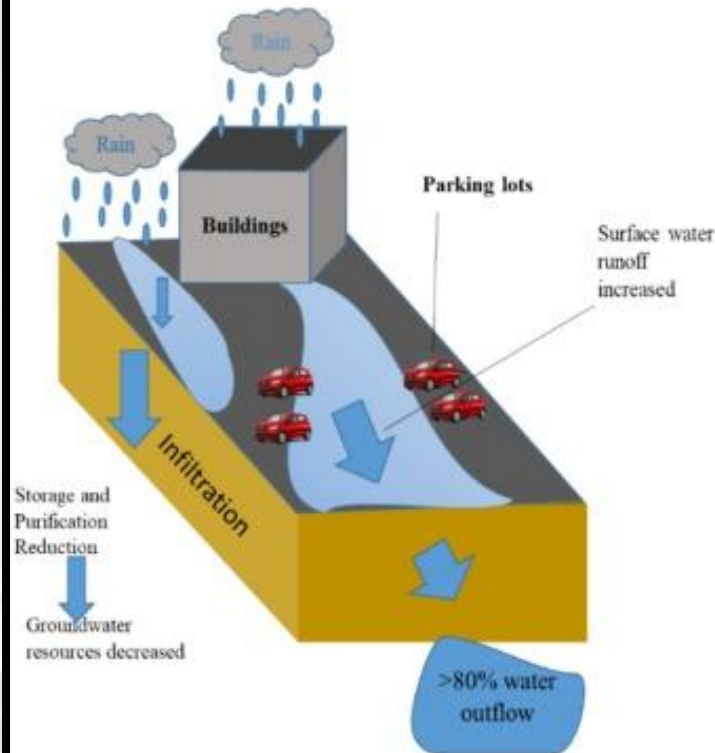


Water use efficiency

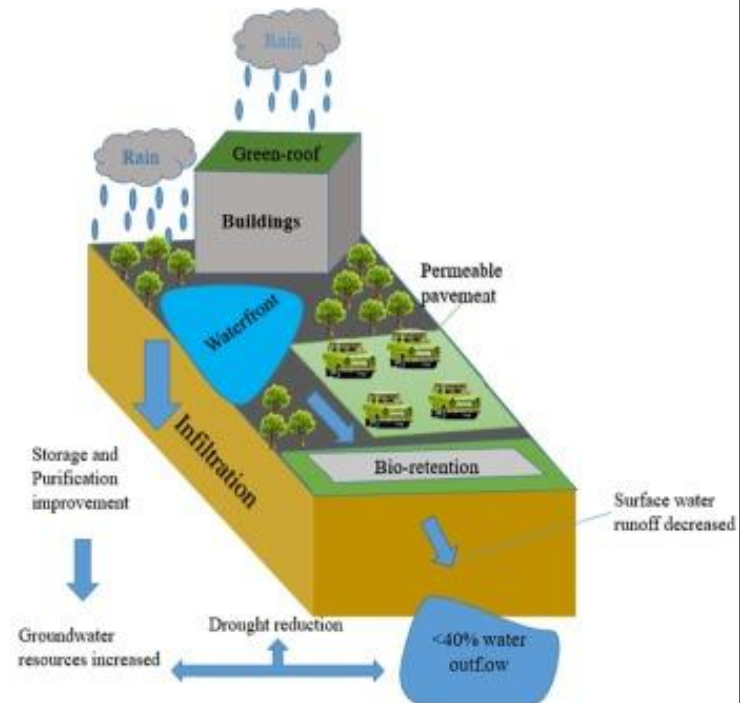
- Capture storm water from impervious areas of the building for ground water recharge or reuse
- Do not use potable water for landscape irrigation
- Install moisture sensor on plants for water conservation
- Use toilet water for toilet flushing
- Use ultra high efficiency water fitting and controls
- Monitor water conservation through on-line controls



Impervious surfaces

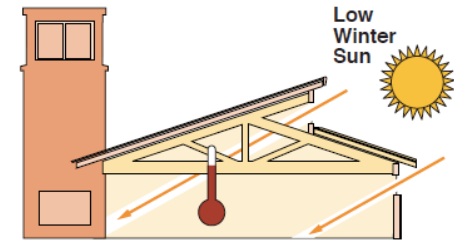


Pervious surfaces

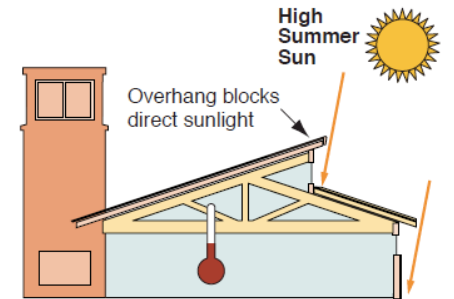


• Energy efficiency

- Design orientation of the building to get maximum daylight
- Use Green wall and Green roof to avoid heat gain into the building
- Use of energy efficient goods



South windows accept direct sunlight to light and warm the building interior



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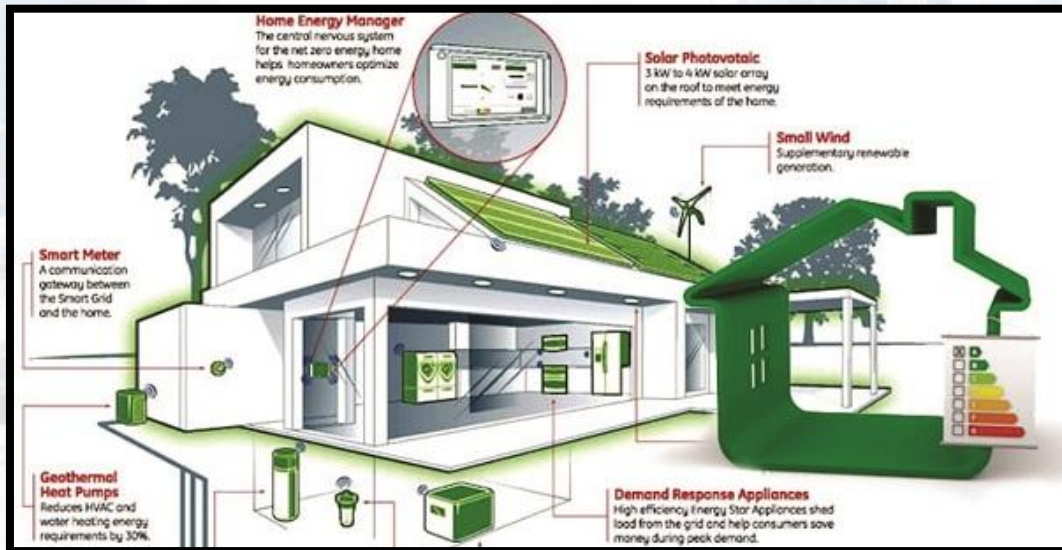
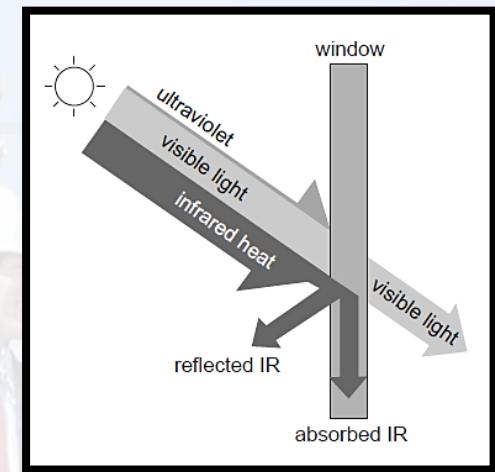


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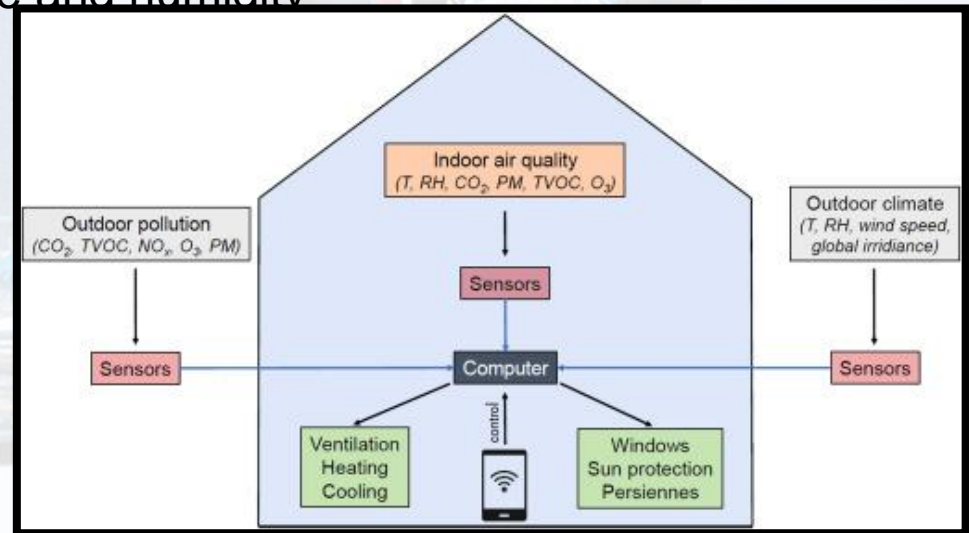
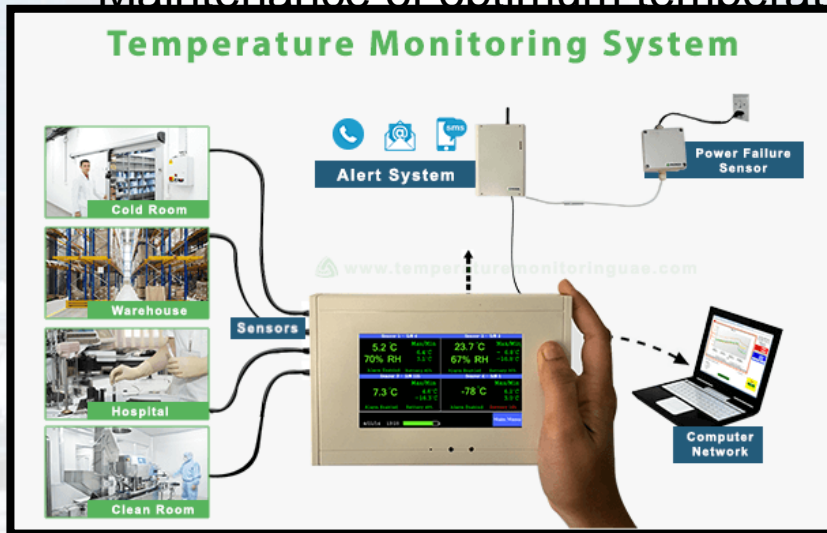
• Energy Efficiency Contd...

- Adopt spectrally natural glass materials such that it reduces heat gain, minimize lighting of landscaping features
- Use zero CFC based Refrigerants in Refrigeration and air-conditioning system
- Use of Renewable Energy to reduce environmental impacts associated with fossil fuels energy use

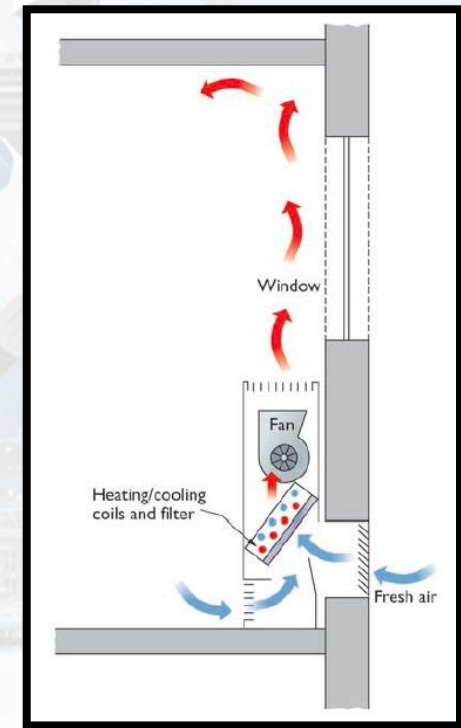
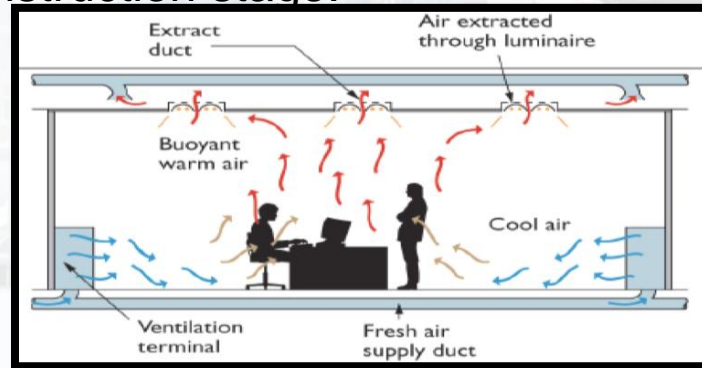


Indoor air quality

- Distribution channels for air intake movement and exhaust
- Climate and pollution monitoring systems
- Elimination of chemically toxic materials and devices
- Maintenance of optimum temperature and humidity



- Emphasize on the use of paints and coatings, adhesives and sealants with less VOC contents which can improve the quality of indoor air.
- Designing the mechanical ventilation systems to meet the minimum fresh air requirements in order to provide continuous supply of fresh air inside the buildings and provide with a minimum separation distance between the air intake and exhaust to prevent the polluted air getting mixed with the fresh air intake by the HVAC systems.
- Proper management and maintenance of HVAC systems during their manufacturing, transport, storage and installation during the construction stage.



• Eco friendly building materials and resources

- The 3 basic steps in selection of materials for construction are
 1. Research
 2. Evaluation
 3. Selection
- Green building materials are composed of renewable, rather than nonrenewable resources. Green materials are environmentally responsible because impacts are considered over the life of the product . Depending upon project-specific goals, an assessment of green materials may involve an evaluation of one or more of the criteria listed below:
 1. Resource efficiency
 2. Indoor air quality
 3. Energy efficiency
 4. Water efficiency
 5. Affordability
- The use of green building materials in the design and construction of a building provides for more energy savings and more efficiency towards the usage of resources. It also reduces the adverse impact that a construction may cause to its environment as well as human health. These materials also lower the cost and ensure the least generation of waste.

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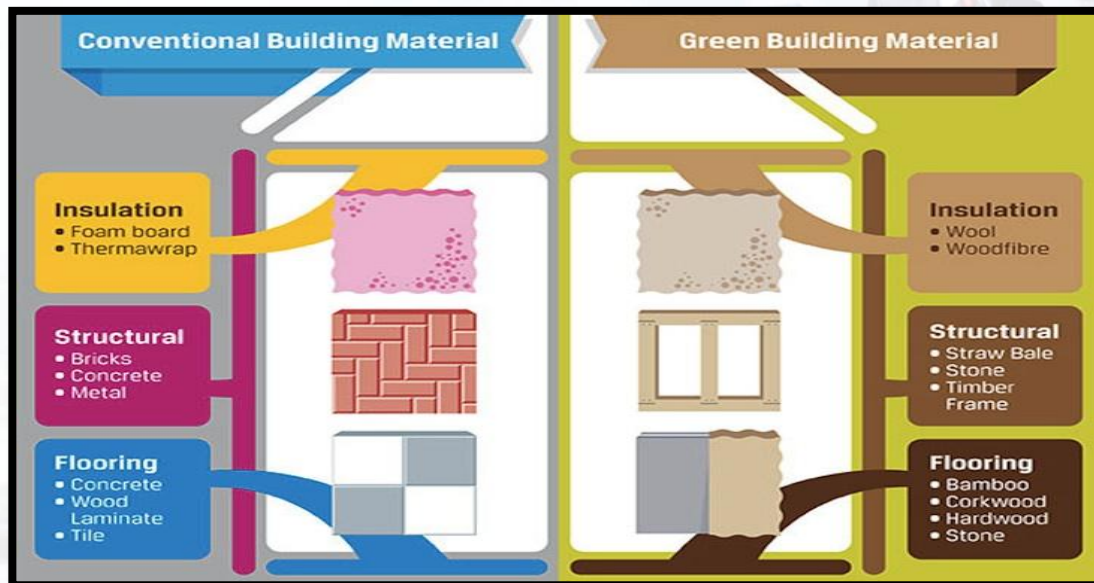
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- Green buildings Construction Materials can provide for easier maintenance, better and higher ROI (return on investment), water and energy efficiency, and a much better indoor air quality. The green buildings are more affordable for the poor, and also provide for water conservation, temperature control, and a better health of the inhabitants.



Some of the materials are:

Wooden bricks: Wooden bricks are manufactured by adding the natural polymers and wool to the brick's clay. These bricks possess 37% greater strength when compared to the traditional bricks and can also resist the cold/wet climate.



Sustainable concrete: The sustainable concrete can provide for lesser emission of the gas carbon dioxide, and hence reduce the environment warming effect. The sustainable concrete made by using crushed class and wood chips/ slag (a steel manufacturing by-product).



Solar tiles: The solar tiles can protect a building from many adverse natural and manmade impacts and agents. As they can absorb good amounts of solar energy, they are an affordable and highly efficient energy source for any building.

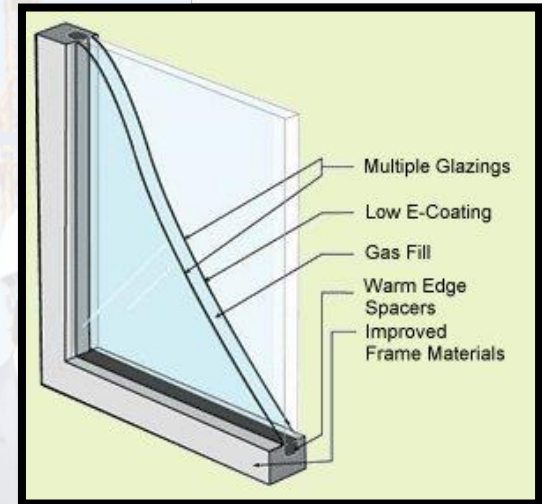


Paper insulation: The insulation paper is highly environmental friendly as it is created from recycled items including cardboards and newspapers, which are subsequently filled with foam (made of chemical). Paper insulation also possesses fire retardant properties and can resist the insects as well.



Glazed Windows: These windows have triple glazing and do not allow heat to enter inside any building.

They are beneficial in instances when a cooler indoor building environment is needed. These Windows can also reduce the inflow of harmful UV (ultraviolet) rays of the sun inside the room or building.



Bamboo: Use of bamboo in place of the steel bars is also getting increasingly common towards the creation of green buildings. For instances, where the usage suffices the purpose, bamboo can be a very useful product. Its use is also environmental friendly



• Waste Management

▪ Eliminating Waste

Some waste generated in the process of construction can be eliminated. For example, durable modular metal form systems for use in concrete construction may be selected on the basis of being readily demountable and reusable on other projects, thus eliminating wood waste associated with formwork fabricated of plywood.

▪ Minimizing Waste

Some building-related waste can be minimized. For example, construction products can be selected on the basis of its being designed and manufactured to be shipped with minimal packaging. Also consider that selection and use of recyclable materials and products offers potential to minimize waste.

▪ Reuse Materials

Some materials can be reused. For example, doors and windows in good, resalable condition might substitute for new products, or be donated and or sold for use on another project—a form of beneficial reuse

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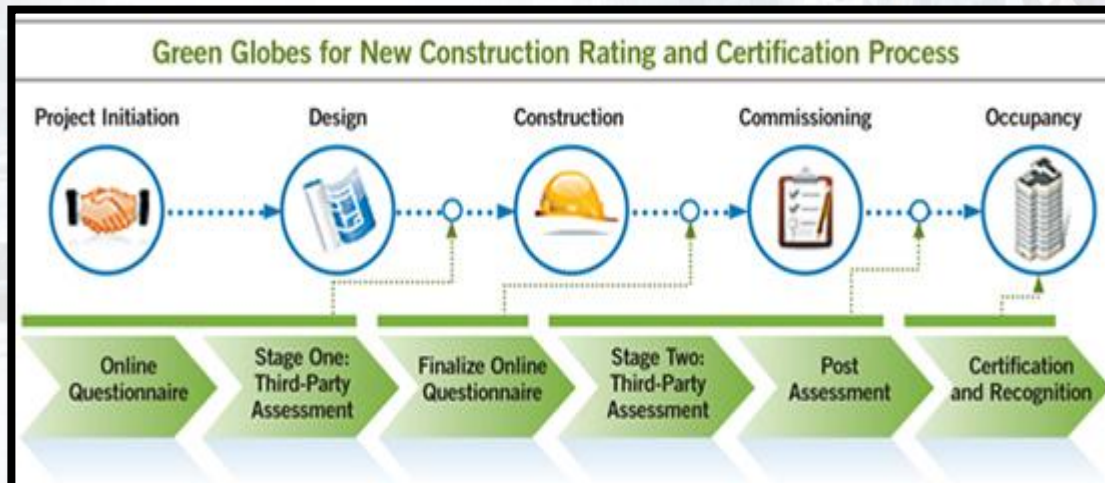
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GREEN BUILDING RATING SYSTEMS

- Rating system is defined as a set of prerequisites and requirements that a project must satisfy in order to get certified.
- Three primary rating systems in India are:
 - 1) GRIHA
 - 2) IGBC
 - 3) BEE
- Different rating systems adopted in other countries are:
 - Building Research Establishment's Environmental Assessment Method(BREEAM) –United Kingdom in 1990
 - Leadership in Energy and Environmental Design-USA in 2000
 - Green Globes – Canada in 2000



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Green Rating for Integrated Habitat Assessment(GRIHA)

India's own rating system jointly developed by TERI and the Ministry of New and Renewable Energy, Government of India and established in 2007.

- GRIHA is Sanskrit word meaning 'abode'
- It is a rating tool that facilitates assessment of the performance of buildings based on nationally accepted conditions or benchmarks.



The main ideology behind the organization is to minimize a building's resource consumption, waste generation, and overall environmental impact by comparing them to certain nationally acceptable limits and benchmarks. It does so, adopting the **Five 'R' philosophy** of sustainable development, namely

1. **Refuse** – to blindly adopt international trends, materials, technologies, products, etc. Specially in areas where local substitutes/equivalents are available
2. **Reduce** – the dependence on high energy products, systems, processes, etc.
3. **Reuse** – materials, products, traditional technologies, so as to reduce the costs incurred in designing buildings as well as in operating them
4. **Recycle** – all possible wastes generated from the building site, during construction, operation and demolition
5. **Reinvent** – engineering systems, designs, and practices such that India creates global examples that the world can follow rather than us following international examples

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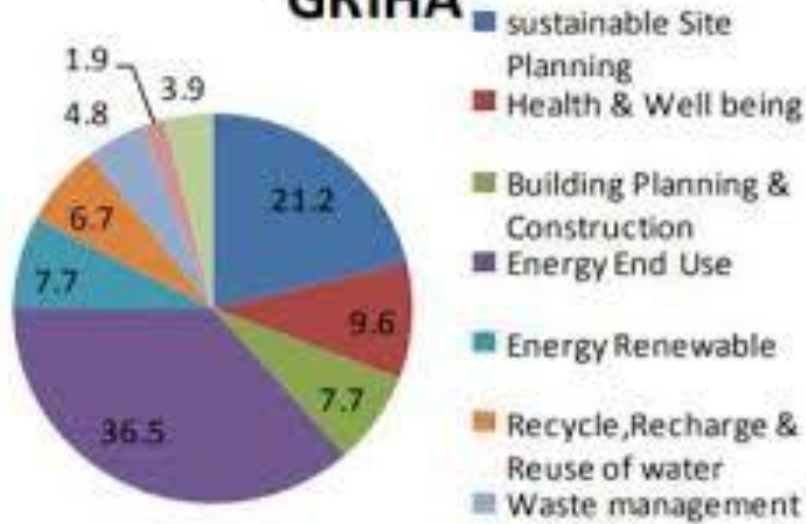
Features of a GRIHA Certified buildings:

- Save Minimum 25% -50% less water than conventional buildings.
- Use less water for construction
- Follow mandatory provisions of ECBC (In case of air conditioned buildings)
- Reduce energy consumption by minimum 10% -50% in comparison to conventional buildings.
- Provide 1% equivalent, connected load of lighting and HVAC through renewable energy for non-residential projects.
- Recycle waste water and reuse at least 25%-75% of treated water.
- Segregate and resource recovery from waste in such a manner that only that minimal or zero waste goes to landfill

Eligibility

All new construction projects with built up area more than 2500 m² (excluding parking, basement area, and typical buildings) are eligible for certification under GRIHA v.2019.

GRIHA



GRIHA V 2015 Rating Thresholds

GRIHA Rating

25-40	★
41-55	★★
56-70	★★★
71-85	★★★★
86 or more	★★★★★



Title: IIM Kozhikode Campus
Location: Kozhikode, Kerala
GRIHA Rating: 5 Star Rating (Version: 3.1)
Rating Type: GRIHA Provisional Rating



Title: New Interim Terminal Building (Domestic),
Vijayawada Airport
Location: Krishna District, Vijayawada, Andhra
Pradesh
GRIHA Rating: 3 Stars
Rating Type: GRIHA Provisional Rating



Title: Indian Institute of Technology (IIT)–
Gandhinagar, Phase 1A
Location: Gandhinagar, Gujarat
GRIHA Rating: 5 Stars
Rating Type: GRIHA LD Masterplan Rating

India Green Building Council(IGBC)

- Confederation of Indian Industry (CII) formed the Indian Green Building Council (IGBC) in year 2001.
- The vision of the council is, "To enable a sustainable built environment for all and facilitate India to be one of the global leaders in the sustainable built environment by 2025".
- IGBC is the non profit research institution having its offices in CII-Sohrabji Godrej Green Business Centre, which is itself a LEED certified Green building.
- Indian Green Building Council (IGBC) has licensed the LEED Green Building Standard from the USGBC. IGBC facilitates Indian green structures to become one of the green buildings.



KEY COMPONENTS OF LEED SYSTEM

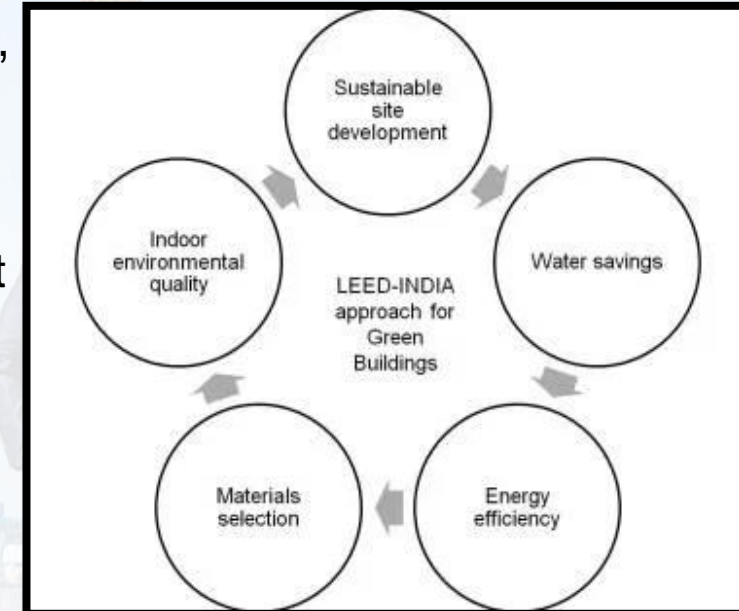
Sustainable sites (construction related pollution prevention, site development impact, transportation alternatives, storm water management, heat island effect, and light pollution)

• **Water efficiency** (landscaping water use reduction, indoor water use reduction, and waste water management strategies)

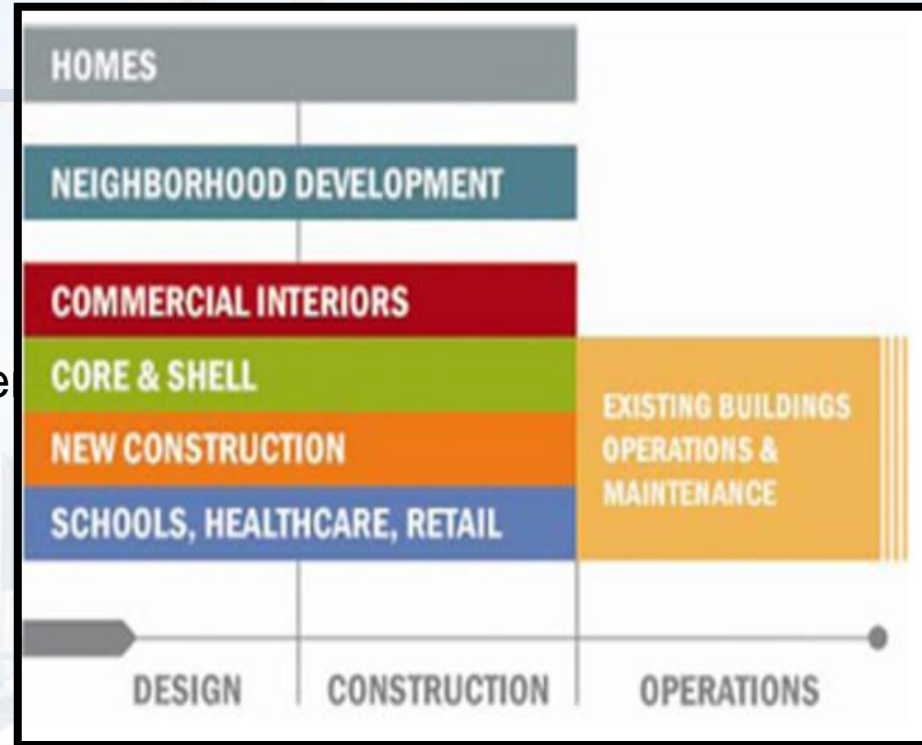
• **Energy and atmosphere** (commissioning, whole building energy performance optimization, refrigerant management, renewable energy use, and measurement and verification)

• **Materials and resources** (recycling collection locations, building reuse, construction waste management, and the purchase of regionally manufactured materials, materials with recycled content, rapidly renewable materials, salvaged materials, and FSC certified wood products)

• **Indoor environmental quality** (environmental tobacco smoke control, outdoor air delivery monitoring, increased ventilation, construction indoor air quality, use low emitting materials, source control, and controllability of thermal and lighting systems)



- IGBC Green New Buildings
- IGBC Green Existing Buildings
- IGBC Green Homes
- IGBC Green Schools
- IGBC Green Factory Building
- IGBC Green Townships
- IGBC Green SEZs
- IGBC Green Landscapes
- IGBC Green Mass Rapid Transit System



GREEN BUILDING CERTIFICATION INSTITUTE

GBCI is the global certification body for the LEED green building program.

LEED was founded more than 20 years ago to provide a road map for developing sustainable buildings.

Today, LEED is the most widely used green building program in the world with more than 102,000 registered and certified commercial projects across

178 countries and territories.

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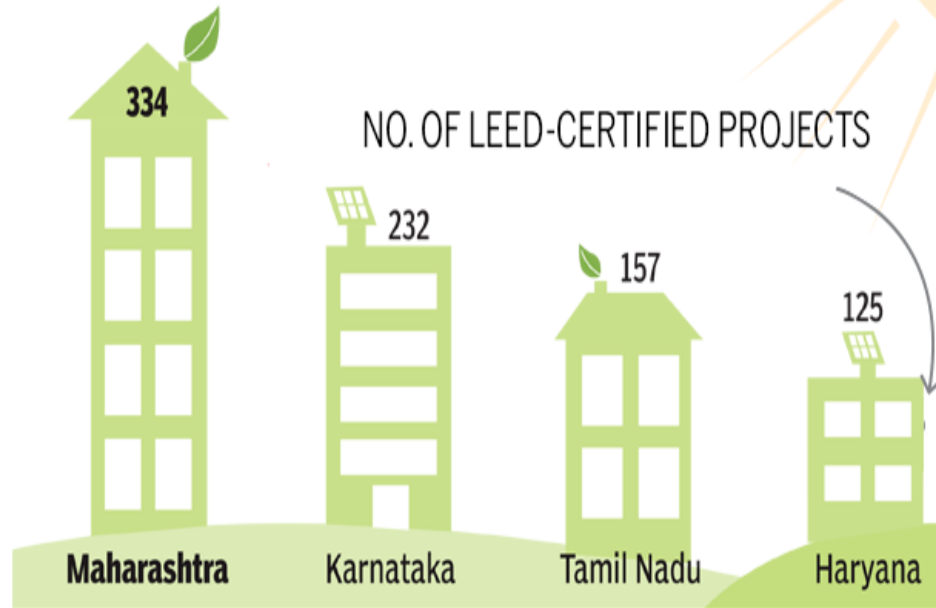
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- The number of points a project earns determines the level of LEED certification.
- There are four levels of certification - the number of points a project earns determines the level of LEED certification that the project will receive



MAHARASHTRA TOPS LEED-CERTIFIED PROJECTS IN INDIA

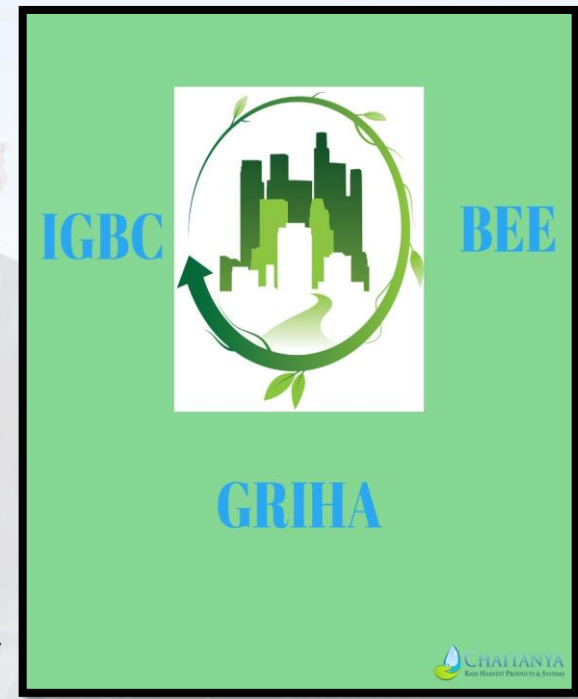


On June 18 2019, the US Green Building Council (USGBC) released the list of India's top ten states. Maharashtra bagged the top slot, followed by Karnataka. It ranks states in terms of cumulative gross sq ft (GSF)

	LEED Projects	GSM Certified
1. Maharashtra	373	10.3M
2. Karnataka	301	9.7M
3. Haryana	139	5.9M
4. Tamil Nadu	178	5.4M
5. Uttar Pradesh	95	4.8M

Bureau of Energy Efficiency (BEE)

- To create a market pull for energy efficient buildings, BEE developed a voluntary Star Rating Programme for commercial buildings
- BEE developed its own rating system for the buildings based on a 1 to 5 star scale. More stars mean more energy efficiency.
- BEE has developed the Energy Performance Index (EPI). The unit of Kilo watt hours per square meter per year is considered for rating the building and especially targets air conditioned and non-air conditioned office buildings.
- So far, about 150 buildings have been rated under various categories.
- The Reserve Bank of India's buildings in Delhi and Bhubaneshwar, the CII Sohrabji Godrej Green Business Centre and many other buildings has received BEE 5 star ratings



BENEFITS OF GREEN BUILDINGS

The benefits of green buildings can be grouped within three categories: environmental, economic and social

Environmental

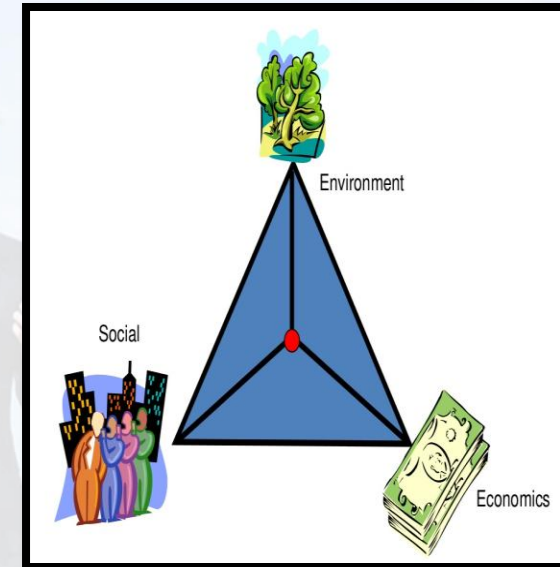
One of the most important types of benefit green buildings offer is to our climate and the natural environment. Green buildings can not only reduce or eliminate negative impacts on the environment, by using less water, energy or natural resources, but they can - in many cases - have a positive impact on the environment (at the building or city scales) by generating their own energy or increasing biodiversity.

At a global level:

- This emissions savings potential is said to be as much as 84 giga tonnes of CO₂ (GtCO₂) by 2050, through direct measures in buildings such as energy efficiency, fuel switching and the use of renewable energy.
- The building sector has the potential to make energy savings of 50% or more in 2050, in support of limiting global temperature rises to 2°C (above pre-industrial levels).

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At a building level:

- Green buildings achieving the Green Star certification in **Australia** have been shown to produce **62%** fewer greenhouse gas emissions than average Australian buildings, and 51% less potable water than if they had been built to meet minimum industry requirements.
- Green buildings certified by the Indian Green Building Council (**IGBC**) results in **energy savings** of **40 - 50%** and **water savings** of **20 - 30%** compared to conventional buildings in India.
- Green buildings achieving the Green Star certification in **South Africa** have been shown to save on average between **30 - 40% energy** and carbon emissions every year, and between **20 - 30% potable water** every year, when compared to the industry norm.
- Green buildings achieving the LEED certification in the **US** and other countries have been shown to consume **25% less energy** and **11% less water**, than non-green buildings

3 | Benefits of 1 billion sq ft Green Buildings
Building environment-friendly structures has many advantages. Some of them are ...

-  **12 million tones** Reduction of carbon dioxide emissions
-  **15,000 gigawatt** Energy savings
-  **45 million litres** Water savings

SOURCE: Indian Green Building Council



Economic

Green buildings offer a number of economic or financial benefits, which are relevant to a range of different people or groups of people.

These include

- Cost savings on utility bills for tenants or households (through energy and water efficiency);
- Lower construction costs and higher property value for building developers;
- Increased occupancy rates or operating costs for building owners; and job creation.
- Building owners report that green buildings - whether new or renovated - command a 7 % increase in asset value over traditional buildings



Social

Green building benefits go beyond economics and the environment, and have been shown to bring positive social impacts too. Many of these benefits are around the health and wellbeing of people who work in green offices or live in green homes.

- Workers in green, well-ventilated offices record a 101 per cent increase in cognitive scores (brain function)
- Employees in offices with windows slept an average of 46 minutes more per night
- Research suggests that better indoor air quality (low concentrations of CO₂ and pollutants, and high ventilation rates) can lead to improvements in performance of up to 8 per cent



GREEN LIGHT

Job potential of the green business in India

GREEN BUILDINGS

100,000
professionals
needed by 2025

RENEWABLE ENERGY BUSINESS

1,400,000
professionals
needed by 2020

MORE IN THE OFFING

CIJ and Rockefeller Foundation's Speed* project

BIOMASS

Each pilot project will create

4 Direct jobs

10 Indirect jobs

SOLAR

Each pilot project will create

1 Direct job

3 Indirect jobs

*Smart Power for Environmentally and Economically Sound Development. The collaboration aims at 50 pilot projects by 2014 based on hybrid alternative technologies

Source: CIJ-GBC, CIJ-MNRE

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We shape our
buildings, and
afterwards
our buildings
shape us.

Winston Churchill

environmentalillnessnetwork.tumblr.com

THANK
YOU

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