# Sustanable Development of A Building and Indian Rating System for Green Building

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***Abstract***—sustainable building is a structure that is environmentally responsible and resource efficient throughout its life cycle. These expand and complement the classical building design, concern of economy, utility, durability and comfort.It subscribe to the principle of conscientious handling of natural resources, which means causing as little environmental interference as possible, using environment friendly materials, requires low operational energy, utilizes renewable sources of energy to fulfil its requirements, follows high-quality guideline for construction and last but not least, must be economically viable. The paper focuses on green design as a vital transformation of contemporary architecture practiced in developing nations. It endeavours to present some environmental and physical design approaches for green buildings in promptly developing countries chiefly India.

***Keywords****-sustainable building, natural material, environment friendly*

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## I. INTRODUCTION

### SUSTAINABLE DEVELOPMENT AND CONSTRUCTION

Sustainable development is defined as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs. In every country, the construction industry is both a major contributor to socio-economic development and a major user of energy and natural resources; therefore its involvement is essential to achieve sustainable development in our society. For example, the construction industry is the European Union's largest industrial sector, contributing approximately 11% to GNP, with more than 25 million people directly and indirectly involved. However, buildings account for more than 40% of total energy consumption, and the construction sector as a whole is responsible for approximately 40% of all human-produced wastes. Hence, the provision of adequate housing and infrastructure for transport, communication, water supply and sanitation, energy supply, and commercial and industrial activities poses a major challenge.

### *SUSTAINABLE BUILDING*

The concept of sustainability in building and construction has evolved over many years. The initial focus was on how to deal with the issue of limited resources, especially energy, and on how to reduce impacts on the natural environment. Emphasis was placed on technical issues such as materials, building components, construction technologies and energy related design concepts. More recently, an appreciation of the significance of non-technical issues has grown. It is now recognised that economic and social sustainability are important, as are the cultural heritage aspects of the built environment.Still, sustainable construction adopts different approaches and is accorded different priorities in different countries. It is not surprising that there are widely divergent views and interpretations between countries with developed market economies and those with developing economies. Countries with mature economies are in the position of being able to devote greater attention to creating more sustainable buildings by upgrading the existing building stock through the application of new developments or the invention and use of innovativetechnologies for energy and material savings, while developing countries are more likely to focus on social equality and economic sustainability.

A green building, also known as a sustainable building, is a structure that is designed, built, renovated, operated, or reused in an ecological and resource-efficient manner. Green buildings are designed to meet certain objectives such as protecting occupant health; improving employee productivity; using energy, water, and other resources more efficiently; and reducing the overall impact to the environment

## II. INNOVATIVE BUILDING MATERIALS: NEED SUSTAINABLE INNOVATION

### 1. WOOL BRICK

Spanish and Scottish researchers have added wool fibres to the clay material used to make bricks and combined these with an alginate, a natural polymer extracted from seaweed. The result is bricks that are stronger and more environmentally friendly The mechanical tests carried out showed the compound to be 37% stronger than other bricks made using unfired stabilised earth. These kinds of bricks can be manufactured without firing. These fibres improve the strength of compressed bricks, reduce the formation of fissures and deformities as a result of contraction, reduce drying time and increase the bricks' resistance to flexion".

Fig. wool brick

### 2. SUSTAINABLE CONCRETE

Concrete is the most commonly used construction material in the world today. In its simplest form, three basic ingredients are required to make concrete – cement (the binder), aggregates (ranging in size from fine to coarse) and water. Cement reacts with water to form hardened silicate compounds that bind all of the individual aggregate components together into one homogenous material – concrete. This reaction is known as hydration. A significant proportion of concrete produced today contains Supplementary Cementitious Materials (SCM)

- Ground granulated iron blast furnace Slag


Fig. Ground granulated blast furnace slag

GGBSis a by-product of the manufacture of steel in a blast furnace. It is formed simultaneously with iron; when cooled rapidly it produces a non-metallic product that can be ground and used as an SCM in concrete.

- Fly ash

Fly ash is one of the residues generated in the combustion of coal.


Fig. fly ash

Fly ash suitable for use as an SCM in concrete is recovered from the precipitators before the chimneys in coal-fired power stations.

- Amorphous silica

Fig. amorphous silica

It covers a range of products, from a naturally-occurring material to by-products of the silicon and ferrosilicon production processes. The latter is sometimes referred to as silica dust,silica powder, silica flour or micro silica.

### 3. SOLAR TILES

Solar tiles convert photons of light into electrical energy using a semi-conductor material. When daylight shines onto a solar cell, electrons are released producing an electrical current. The volume of solar electricity produced depends on the intensity of the light received by the solar cell. Solar roof tiles have an increased life span of 30 years. Most of these tiles are designed in such a manner that it can be replaced whenever necessary. It also protects the roofing materials and insulation to generate electricity in an appropriate manner.

Fig. Solar tiles

4. PAPER INSULATION

Enhanced insulation in timber-frame housing using recycled materials has developed a process for the mass production of pre-insulated panels at modest cost by using the cellulose fibres in waste paper. In this method waste paper converted into a pulp which possesses strong insulating properties, and can be employed as a cheap and environmentally friendly filler for timber building panels.

Fig. Paper Insulation

5. TRIPLE GLAZED WINDOW

Triple glazing utilises three sheets of glass in a building's doors, windows and roof lights to help provide improved sound and thermal insulation in comparison with single and double-glazing. Windows have a variety of uses such as allowing light into a building, enabling the occupant to look out of their home and, at the same time, keeping the inclement weather out. Although this can all be achieved by a window with a single pane of glass, triple glazed units provide the added benefit of providing greater insulation against the loss of heat, keep at bay more of the wind and rain and reduce noise levels from outside the home. The three panes of glass may be treated with a low-emissivity metallic coating that reflect some of the heat back into the home to increase their energy efficiency and are incorporated within a rigid sealed unit with an air gap between each sheet of glass so, instead of having one air gap in the case of double glazing, there would be two. The gap may be filled with an inert gas such as xenon, krypton or argon to reduce the heat loss even further. The sealed unit is normally constructed of wood or uPVC.


Fig.Triple glazed window

6. BAMBOO REPLACING STEEL BARS

A bamboo floor is a type of flooring manufactured from the bamboo plant. The majority of today's bamboo flooring products originates in China and other portions of Asia. Moso bamboo is the species most commonly used for flooring. The stranded flooring is made of bamboo fibres, rather than strips. The fibres are softened, then separated, before being put back together as planks. The stranded board is then sanded and coated with an aluminium oxide finish for resiliency. Bamboo flooring also is valued for its eco-friendliness.


Fig. Bamboo reinforcement

7. LOW VOC PAINT

Some of the most harmful chemicals found in paint are **volatile organic compounds**, or **VOCs**. These chemicals aren't something you want to spray on your body or potentially even keep inside your house.


Fig. Low VOC paint

VOCs are unstable, carbon-contain incompounds that readily vaporize into the air. When they enter the air, they react with other elements to produce ozone, which causes air pollution and a host of health issues including breathing problems, headache, burning, watery eyes and nausea. Some VOCs also have been linked to cancer, as well as kidney and liver damage to prevent from this low VOC paint is used.

8. BAMBOO FLOORING

All types of bamboo flooring are durable and considered a similar strength to Oak flooring. There is one particular type of

bamboo flooring (strand woven bamboo)that is exceptionally strong and hard-wearing due to the way in which it has been constructed, and is over twice as hard as Oak, making it a great choice for high traffic areas in domestic properties, and popular flooring for commercial developments.

Not only is bamboo flooring hardwearing, it is also dimensionally stable, meaning that it can withstand changes in temperature and humidity, and can be fitted in a number of different ways over almost any subfloor:

Fig. Bamboo flooring

• Bamboo flooring can be installed in conservatories or rooms with large amounts of glazing.
• You have the choice of floating your bamboo floor over an underlay or fixing it into position.
• You can install your bamboo floor over any subfloor that has been properly prepared.

## 9. BAMBOO CORRUGATED SHEET

Bamboo has been intensively utilized as a building material since ancient times. However, due to the scarcity of wood in recent years, bamboo has gained great importance as a source of renewable fiber as a suitable alternative to wood. Particularly, bamboo is suitable for low cost housing in earthquake-prone regions due to its sturdiness and versatility. This versatile forest produce lends itself to be manufactured into mat-based industrial products such as bamboo mat board, bamboo mat veneer composite, bamboo mat moulded products, bamboo mat corrugated sheet for roofing, etc.

Fig. Bamboo corrugated sheet

Among these, the bamboo mat corrugated sheet is an ideal substitute for asbestos and galvanized steel sheets for roofing purposes. The Indian Plywood Industries Research & Training Institute (IPIRTI) has developed this technique, which has proved to be a boon for the housing industries among North Eastern states. Since corrugated sheets are most versatile for roofing, development of corrugated sheets from bamboo mats was taken up at IPIRTI, under a project sponsored by the BMTPC. Sinusoidal wave platens have been designed for hot pressing phenol formaldehyde resin coated and preservative treated bamboo mats into corrugated sheets. These sheets are environment friendly, energy efficient and possess good fire resistance as well.

## 10. RICE HUSK ASH CONCRETE

Fig.Rice Husk Ash | HIWTC

Rice Husk Ash (RHA) produced after burning of rice husks can be used as an admixture for concrete. RHA has high reactivity and pozzolanic property, which improves the workability and solidity of the cement. Portland cement contains 60-65% Calcium oxide and, upon hydration, a considerable portion of lime is released as free Calcium Hydroxide. This is primarily responsible for the poor performance of Portland cement concretes in acidic environments. Silica present in Rice husk ash combines with the calcium hydroxide resulting in excellent resistance to acidic environments.

RHA concrete also reduces heat evolution during slaking, increases strength, impermeability and durability by strengthening transition zone, modifying the pore-structure and also plugs the voids in the hydrated cement paste through the pozzolanic reaction. Minimizing the alkali-aggregate reaction, it also reduces expansion and distills pore structure and hinders diffusion of alkali ions to the surface of aggregate by micro porous structure. Silica in the RHA combines with the calcium hydroxide resulting in excellent resistance to the acidic environments. RHA mixed concrete has been found to be very workable and durable based on the several tests. RHA-concrete can prove to be boon for the cement and the concrete industry in several parts of the country because of large production of paddy in India.

11. PLASTIC BRICKS

The concept of plastic bricks first came up in Africa when in an experimental project financed by a European Union, plastic bags were melted and transformed into bricks with a cement mold saving both money and time. The plastic bags were used to fill the potholes in Niger in a way to solve the problem of waste disposal. Plastic waste bricks are not only inexpensive but are also easily workable. The waste plastic is collected from various sources and then diligently sorted. It is then washed and sanitized. After that, it is shredded to cotton like consistency to form what is known as 'plastic cotton'. The shredded plastic is then mixed with mud and packed away as bricks.

Fig. Plastic Bricks Spluch

Plastic bricks have been extensively used in highway and railway infrastructure. Plastic from the millions of the bottles and bags are melted and molded in the form of bricks are used in the construction of the roads. This has considerably enhanced the elastic nature of the surface helping in more load-bearing capacity of highways. In India, this technology has been initiated on an experimental basis for railway sleepers, but was stopped since the danger to fire is a major concern.

12. Bagasse Particle Board

Fig. Bagasse Particle Board

Bagasse is the residual pulp from sugarcane after the juice has been extracted. A considerable amount of excess bagasse generated from sugar mills is left to rot or burnt as fuel for boilers. This by-product is now being used as a substitute for wood in particle boards that are light and low cost. Bagasse-based composites offer potential as the core Bagasse is the residual pulp from sugarcane after the juice has been extracted. A considerable amount of excess bagasse generated from sugar mills is left to rot or burnt as fuel for boilers. This by-product is now being used as a substitute for wood in particle boards that are light and low cost. Bagasse-based composites offer potential as the core material for laminated floors, replacing high-density and expensive wood fiberboard. As such, bagasse does not have enough strength and water resistance to be used on its own. However, if it is made into a laminated particle board with resin as a bonding agent and wax as dimensional stabilizer, then it can be used for laminated floor and furniture applications.

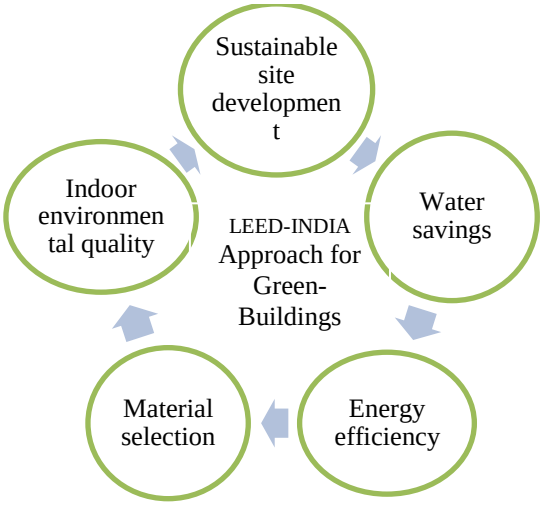
## III. GREEN BUILDING RATING SYSTEMS IN INDIA

A green building rating system is a tool that evaluates the performance of a building and its impact on the environment. It comprises a predefined set of criteria relating to the design, construction, and operations of green buildings.

In India, there are predominantly three rating systems – Leadership in Energy and Environmental Design (LEED), the rating systems from Indian Green Building Council (IGBC) and the Green Rating for Integrated Habitat Assessment (GRIHA). In addition, there is also the Energy Consumption Building Code (ECBC) and the National Building Code (NBC), which provide guidelines on energy consumption. All buildings in India need to comply with these prescribed guidelines.

- LEED

The Leadership in Energy & Environmental Design (LEED) is the rating system developed for certifying Green Buildings. LEED is developed by the U.S. Green Building Council (USGBC), the organization promoting sustainability through Green Buildings.



Important to note, that there are about 650 LEED certified projects in India and 4500 more have registered for certification.

LEED India Green building Rating System Certification levels

| **Rating** | **points** |
|---|---|
| LEED Certified | 26-32 |
| LEED Certified Silver level | 33-38 |
| LEED Certified Gold level | 39-51 |
| LEED Certified Platinum level | 52-69 |

Few LEED rated buildings in India

- **Platinum rated** : CII –Godrej GBC ,Hyderabad ITC Green Center, Gurgaon Wipro Technologies, Gurgaon.
- **Gold Rated** : IGP Office, Gulbarga NEG Micon, Chennai Grundfos Pumps, Chennai.
- **Silver Rated** : L&T EDRC , Chennai

Important criterions and Point allocation

| Sr.no: | Criterions | Points |
|---|---|---|
| | Prerequisites | 8 |
| 1 | Sustainable Sites | 13 |
| 2 | Water efficiency | 6 |
| 3 | Energy and atmosphere | 17 |
| 4 | Materials and Resources | 13 |
| 5 | Indoor Environmental quality | 15 |
| 6 | Innovations and Accredited Prof. Points | 5 |
| | Total | 69 |

Credits under sustainable site

| Credit | Title | Points |
|---|---|---|
| Prereq 1 | Erosion and Sedimentation Control | 1 |
| Credit 1 | Site Selection | 1 |
| Credit 2 | Development density and Community connectivity | 1 |
| Credit 3 | Brownfield redevelopmen | 1 |
| Credit 4 | Alternative transportation | 1-3 |
| Credit 5 | Site development | 1-2 |
| Credit6 | Storm water design | 1-2 |
| Credit 7 | Heat Islands Effect | 1-2 |
| Credit 8 | Light pollution reduction | 1 |
| | 1Total | 13 |

Water Efficiency

| Credit | Title | Points |
|---|---|---|
| Credit 1 | Water Efficient Landscaping | 1-2 |
| Credit 2 | Water efficiency in A/C systems | 1 |
| Credit 3 | Innovative wastewater technologies | 1 |
| Credit 4 | Water use reduction | 1-2 |
| | Total | **6** |

Credits under Material and resource

| Credit Title Points | Title | Points |
|---|---|---|
| Prereq 1 | Storage & collection of recyclables | R |
| Credit 1 | Construction waste management | 3 |
| Credit 2 | Resource Reuse | 2 |
| Credit 3 | Recycled content | **2** |
| Credit 4 | 4 Local / Regional Materials | **2** |
| Credit 5 | Rapidly Renewable material | **1** |
| Credit 6 | Certified Wood | **1** |
| | Total | **13** |

Credit : Recycled Content

| Materials | % Recycled contents |
|---|---|
| Fly ash blocks | 30-40 |
| Glass | 10-15 |
| Ceramic tiles | 20-30 |
| MDF wood | 15 |
| Steel | 20-25 |
| False roof | 25-30 |

Indoor Environmental Quality

| Credit | Title | Points |
|---|---|---|
| Prereq 1 | Minimum IAQ Performance | R |
| Prereq 2 | Environmental Tobacco Smoke (ETS) control | R |
| Credit 1 | Outdoor Air Delivery Monitoring | 1 |
| Credit 2 | Increased Ventilation | 1 |
| Credit 3 | Construction IAQ Management Plan | 2 |

| | | |
|---|---|---|
| Credit 4 | Low-emitting Material | 4 |
| Credit 5 | Indoor Chemical & Pollutant Source Control | 1 |
| Credit 6 | Controllability of system | 2 |
| Credit 7 | Thermal Control | 2 |
| Credit 8 | Daylight & Views | 2 |
| | Total | 15 |

- GRIHA

Green Rating for Integrated Habitat Assessment GRIHA is India's National Rating System for Green buildings. It has been developed by TERI (The Energy and Resources Institute) and is endorsed by the MNRE (Ministry of New and Renewable Energy). It is based on nationally accepted energy and environmental principles, and seeks to strike a balance between established practices and emerging concepts, both national and international.

Project scoring

1. 50-60 points is certified as a 1 star GRIHA rated building,
2. 61-70 is a 2 star GRIHA rated building,
3. 71-80 is a 3 star GRIHA rating building,
4. 81-90 is a 4 star GRIHA rated building and
5. 91-100 is a 5 star GRIHA rated building

GRIHA evaluates projects on the following 14 criteria:

| Criterion number | Criterion name | Points |
|---|---|---|
| 1 | Reduce urban heat island effect and maintain native vegetation cover on site | 6 |
| 2 | 2 Passive architectural design and systems | 4 |
| 3 | Good fenestration design for reducing direct heat gain and glare while maximising daylight penetration | 6 |
| 4 | Efficient artificial lighting system | 2 |
| 5 | Thermal efficiency of building envelope | 2 |
| 6 | Use of energy efficient appliances | 3 |
| 7 | Use of renewable energy on site | 4 |
| 8 | Reduction in building and landscape water demand | 5 |
| 9 | Rainwater harvesting | 4 |
| 10 | Generate resource from waste | 2 |
| 11 | Reduce embodied energy of building | |
| 12 | Use of low-energy materials in interiors | 4 |
| 13 | Adoption of green Lifestyle | 4 |
| 14 | Innovation | 2 |
| | Total | 50 |

- IGBC

IGBC Green New Buildings rating system® is designed primarily for new buildings, both for air-conditioned and non-air-conditioned buildings. New Buildings include (but are not limited to) offices, IT parks, banks, shopping malls, hotels, hospitals, airports, stadiums, convention centres, educational institutions (colleges, universities), libraries, museums, etc., Building types such as residential, factory buildings, schools, integrated townships will be covered under other IGBC rating programmes. IGBC Green New Buildings rating system is broadly classified into two types:

1. Owner-occupied buildings are those wherein 51% or more of the building's built-up area is occupied by the owner.
2. Tenant-occupied buildings are those wherein 51% or more of the building's built-up area is occupied by the tenants.The threshold criteria for certification levels are as under:

| **Certification Level** | **Owner-occupied building** | **Tenant-occupied building** | **Recognition** |
|---|---|---|---|
| Certified | 50 – 59 | 50 – 59 | Good Practices |
| Silver | 60-69 | 60-69 | Best Practices |
| Gold | 70-79 | 70-79 | Outstanding Performance |
| Platinum | 80-89 | 80-89 | National Excellence |
| Super Platinum | 90-100 | 90-100 | Global Leadership |

## IV. SUSTAINABLE BUILDINGS IN INDIA

Depleting natural resources, rapid industrialization and urbanization has led to a negative impact on the environment. Eco-friendly buildings that are energy efficient and use water management techniques are the need of the hour. Some developers have succeeded in creating such buildings. Let us have a look at India's top 10 green buildings:

1. ITC Green centre, Gurgaon

Spread across a sprawling 1,80,000 sq. feet, the ITC green centre has said benchmark for green buildings in India. Located in sector-32, Gurgaon, the building has been awarded the platinum green building rating by USGBC-LEED (Green building council-leadership in energy and environmental design), making it the first corporate house in India to back this award.

The building is designed keeping in mind the highest environmental standards.it is made up of bricks and concrete comprising of fly ash and is equipped with high efficiency equipment that reduce 53 present energy consumption over a conventional building and 40 present reduction in potable water. Zero water discharge solar thermal technology, storm water management system, reflective high-albedo roof paint, minimum exterior lighting and separate smoking rooms with exhaust system are some of the other features of the building.

2. Suzlon One Earth, Pune

With a capacity to accommodate 2300 people, 'One Earth' is another building that has received platinum certifications of LEED. The building is built using low energy materials thus, reducing carbon footprint. 90 percent of the occupied space of the building has access to natural daylight while the exterior of the building uses renewable energy based LED street lightning reducing approximately 25 percent of the total power. The ventilation system consists of jet fans that save 50 percent energy by periodically pushing out stale air and bringing in fresh air.

3. Patni (i-GATE) knowledge centre, Noida

Awarded with the prestigious LEED Platinum rating, Patni Knowledge Centre is next on the list of green buildings in India. Located in suburban Noida and built over 4,60,000 square feet, the buildings depth is designed in such a way that it captures daylight for 75 percent of the occupied interiors. 50 percent of the area is reserved for open green space. In addition to this, the campus follows the efficient water management practices like rain water harvesting, solar water heating and drip irrigation. 100 percent sewage is treated and the recycled water is used for the purpose of cooling the tower make up, gardening and flushing.

4. Olympia tech park, Chennai

Located in the heart of Chennai (Guindy), The Olympia Tech Park has become one of the biggest and most sought after IT Parks in Chennai. The Tech Park house MNCs that operates day and night which is why energy saving features and eco –friendly environment becomes a necessity. Rated as one of the largest gold LEED rating building in the world, the building makes use of energy and water saving techniques (rain water harvesting) and recycling and to attain zero percent discharge. The dual plumbing line of the building which helps treating gray water is used for flushing or in irrigation.

5. Infinity, Benchmark, Kolkata

Next on the list is Infinity Benchmark, another LEED platinum level certified green building which covers an area of 5,60,000 sq.ft. ans is spread over 20 stories. The air quality inside the building is maintained by $CO_2$ monitoring sensors and intelligent humidification controls. External was of the building are made of brick wall block while the roof has under deck thick polyurethane foam for better insulation. Environment friendly technique like use of electric as within the complex is used along with energy efficient equipment and waste water recycling system.

6. CRISIL House, Mumbai

With 14 gardens inside the complex, CRISIL House is rated as one of the greenest commercial complexes in India. The interiors of the building are made up of recycled construction material while the atrium at the centre of the building allows natural light to seep is covering 70 percent of the work area. At night, energy efficient artificial lighting is used thus, reducing the carbon footprint. The natural lighting technique has helped reduced power consumption by 40 percent.

7. Indira ParyavaranBhawan

Located in JorBagh, New Delhi, this 8 storied structure has been given a platinum rating by LEED and a five star rating by the energy and research institutes GRIHA (Green Rating for Integrated Habited Assessment). The building uses Geo-thermal heat exchange system to reduce the power requirement to run air conditioners and recycles all its water thereby reducing water demand by over 50 percent.

1. ITC Maurya Hotel, New Delhi.

The ITC Maurya is the world's first and largest LEED Platinum rated hotel to use parabolic solar concentrators, the magnificient building has been awarded with the 'Best Eco-friendly Hotel' at India's National Tourism Awards and recycles almost 99 percent of its solid waste (by means of recycling programmes or composting). Over 30 percent of food and beverages used are locally sourced harvested and processed within a radius of 160 kms. Another distinguishing feature of the building is that it uses low VOC (Volatile Organic Compounds) paints.

2. Infosys, Hyderabad

Winner of the UK's prestigious Ashden Awards, also known as the 'Green Oscars', Infosys has given a new high energy efficient as the world knows it. The software giant's 460 acres Pocharam campus in Hyderabad has become a laboratory to test the construction technology. Three of its software developments blocks (SDB) 1,2&3 are LEED Platinum rated.

Buildings in the campus are constructed a long passive design principles such as minimising heat and glare, strategically situated windows, white painted roofs and radiant cooling technology (pumping cold water through pipes

embedded in concrete). The building uses efficient building envelope (that included high performance glazing, ample shading, radiant cooling, etc), energy efficient lighting and HVAC (heat, ventilation and air conditioning) system to achieve energy efficiency.

8. Cisco building, Bangalore

Cisco's B-16 office in Bangalore has been awarded the LEED Platinum ID + C (Interior Design and Construction) certification by the USGBC for scoring 96 out of 110 total points. The campus source more than 70, 00,000 Kwh of green power per annum and recycles 100 percent of waste water. It has a high performance glazing and energy efficient HVAC design and uses recycled materials and rapidly renewable materials for construction. Ventilation and temperature controls enable occupants (approx. 51 percent) to adjust temperatures according to their preferences.

9. Confederation of Indian Industries (CII) building, Hyderabad

At the time of its opening in 2004, the CII building was the first LEED Platinum rated green building in the ward outside of the United States. It is also India's first LEED certified building (being rated in October, 2003). The building is an embodiment of modern construction with 55 percent of the 20,000 sq. ft. Structure being covered by a green roof in addition to having performance windows, biological water treatment ponds and wind towers. 90 percent of the building does not require artificial lighting during day time while 20 percent of the buildings total energy requirements are generated by solar panels. In addition to this, the building recycles 100 percent of waste water making it a zero water discharge building.

With more and more buildings going green, India is on the fast track to reduce its carbon footprint and in the process, saving on operational costs and well as contributing to human health. Building green is one of the solutions to contain global warming and the surging sea levels, sans doubt it is the future of global construction.

## V. CONCLUSION

Green building is today the most widely used form. Creating green buildings is an important focus of building owners and even governments worldwide. In India some world class Green Buildings have constructed in past few years, but still the concept of green buildings for general masses is in infancy stage. Considering the tremendous potential available for green materials and equipment, India would be the destination for several manufactures. This coupled with favourable policies of the Government would provide the right impetus for advancing the green building movement in India.

Present work is an attempt in the direction to make people, communities and general public aware about the advantages of green buildings for sustainable environmental development and management.

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