GREEN BUILDING

WHAT IS A GREEN BUILDING ?

- A green building is one constructed with **design and construction processes** which significantly **reduce or eliminate negative impact** of buildings on the **environment and occupants.**

FUNDAMENTAL OBJECTIVES OF GREEN BUILDINGS

- Conserve nature and natural resources
  - Building construction involves damage to ecology through land use disturbance; energy intensive material and processes.
- Increase energy efficiency
  - Buildings consume about 50% of total energy. Energy consumption is growing at rate higher than population growth rate.

FUNDAMENTAL OBJECTIVES OF GREEN BUILDINGS

- Improve indoor air quality
  - Construction materials such as paints and varnishes emit polluting gases like nitrous oxide and carbon dioxide.

BENEFITS FROM GREEN BUILDINGS

- Reduced destruction to ecology
- Efficient use of resources during construction
- Reduced construction waste
- Reduced energy consumption
- Extensive use of renewable energy
- Efficient water management
- Better indoor air quality by use of non-toxic materials

ECONOMICS

- Over a 40 year life cycle of building the energy costs exceed construction costs.

- A green building may cost 10% - 40% more but energy cost would go down by 30% -65%.

- The **break-even point** is achieved depending upon the **energy consumption**.

STRATEGIES FOR BUILDING GREEN BUILDING

- Optimum use of nature for lighting and space conditioning
- Energy efficient light fittings
- ‘Intelligent’ features to reduce energy wastage
- Use of renewable sources of energy
- Bio-climatic architectural principles
- Reducing material use in construction
- Recycling of construction wastes
- Efficient water management

BIOCLIMATIC ARCHITECTURAL PRINCIPLES

- Orientation
- Thermal mass
- Building Forms (surface to volume ratio etc.)
- Position and size of window; shading and coatings
- Selection of materials for wall, roof, windows including insulation
- Thermal insulation of roof, wall and glazing
- Landscaping

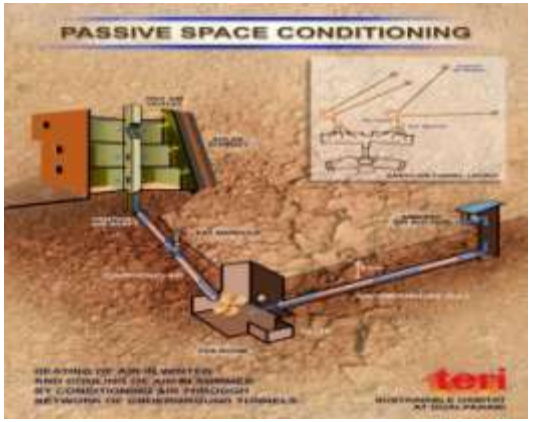
✓ These can lead to 10-30% reduction in energy use

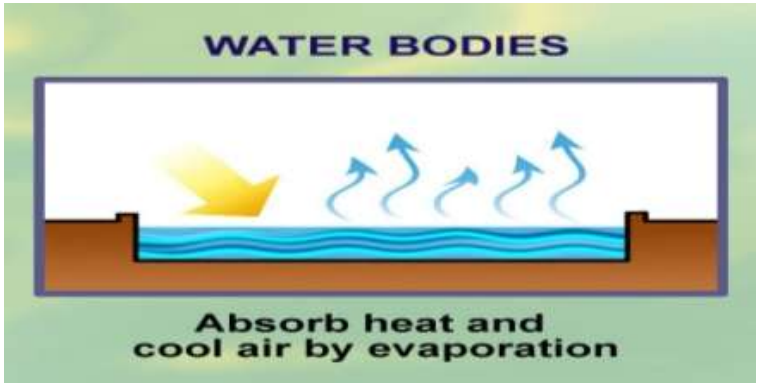
SOLAR ACTIVE FEATURES

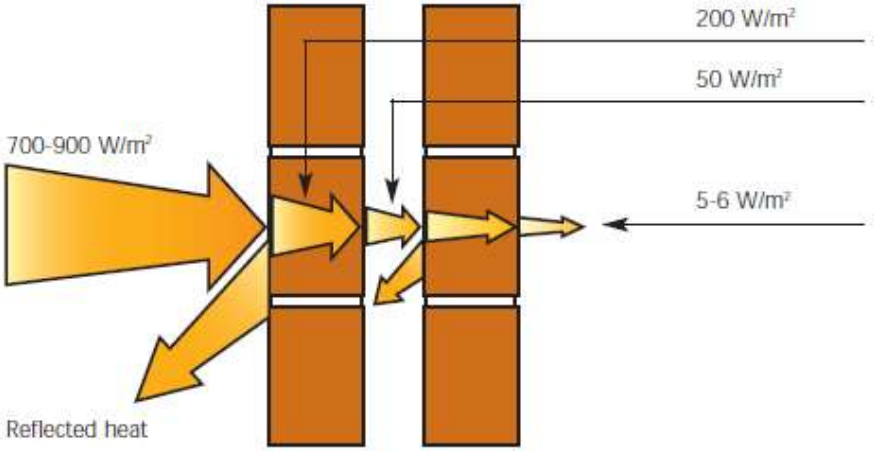
- Solar water heater
- Solar power

SOLAR PASSIVE FEATURES

- Earth tunnel
- Solar chimney
- Wind Tower
- Cavity wall
- Courtyard effect
- Landscaping







RATING SYSTEM

- ***BREEAM***
  - Building Research Establishment's Environmental Assessment Method
  - developed in United Kingdom in 1990
- ***LEED***
  - Leadership in Energy and Environmental Design
  - developed and piloted in the US in 1998
  - LEED-INDIA developed in 2006
- ***CASBEE***
  - Comprehensive Assessment System for Building Environmental Efficiency
  - Developed in Japan, in 2001
- **GRIHA**
  - Green Rating for Integrated Habitat Assessment
  - By TERI (The Energy and Resources Institute) in India in 2005

Rating Systems

- **LEED (L**eadership in **E**nergy and **E**nvironmental **D**esign)
  - **Five Key Area and 69 points**
    - Sustainable site development
    - Water savings
    - Energy efficiency
    - Materials selection and
    - Indoor environmental quality
  - **Rated as certified Level to platinum Level**

LEED Rating System

Rating	No. of points Max 69	No. of points (2011) Max 110
LEED Certified	26-32	40-49
LEED Certified Silver level	33-38	50-59
LEED Certified Gold Level	39-51	60-79
LEED Certified Platinum Level	52-69	Above 80

Rating Systems

- **TERI (The Energy & Resources Institute)**
  - **Three Key Area, 33 criteria and 100 points**
    - Site selection & site planning(9, 24)
      - **Conservation and efficient utilization of resource(7, 20)**
      - **Health and well being during construction** (2, 4)
    - Building Planning & Construction(22, 74)
      - **Conservation and efficient utilization of resource(16, 64)**
        - **Water(3, 6)**
        - **Energy: end use(2, 24)**
        - **Energy: embodied and construction(3, 14)**
        - **Energy: renewable(2, 8)**
        - **Recycle, recharge, and reuse of water(2, 7)**
        - **Waste management(4, 5)**
      - **Health and well-being during post-construction occupation(6, 10)**
    - Building operation & Maintenance(2,2)
    - Innovations(4,4)
  - **Rated as one star to five star**

TERI Rating System

Rating	No. of points
One Star	50-60
Two Star	61-70
Three Star	71-80
Four Star	81-90
Five Star	91-100

Green Buildings in India

- **Under certification of IGBC/USGBC**
  - **2512 buildings registered out of which**
  - **481 are certified**
- **Under certification of TERI**
  - **43 are certified**
    - **GRIHA Final 3 (1 five star, 2 three star)**
    - **GRIHA Provisional 17 (9 five star, 3 four star, 2 three star & 3 two star)**
    - **GRIHA Pre 17 (1 five star, 8 four star, 6 three star & 2 two star)**
    - **SAV GRIHA 5 (3 five star, 3 four star)**

Green Buildings in India

- **CII- SOHRABJI GODREJ GREEN BUSINESS CENTRE, HYDERABAD**
- **Teri Retreat- A Model Green Building**
- **BSBES Building, IIT Kanpur**
- ITC TOWER, GURGAON

New IRICEN Administrative Building

- Total plinth area of 8700 sqm
- RCC framed stilt + 4 floors
- First floor
  - Museum , Laboratory and Auditorium
- Second floor
  - Library, reading room and office
- 3rd floor
  - 5 class rooms & conference room
- On top floor
  - all faculty rooms & Meeting room

NEW IRICEN BUILDING

- Work sanctioned in WP 2004-05
- Shashi Prabhu Associates,Mumbai appointed Architectural Consultant in Oct. 2005
- During finalization of plan & in compliance with Works Standards Committee's recommendation, it was decided that
  - Building be designed as "Green Building"
  - Get the building rated for the 'Greenness'
- Phase II work included in WP 2007-08
- CII-GBC appointed as consultant for feasibility study for getting LEED rating
  - As per feasibility report, building to get LEED-INDIA Gold/Platinum rating which is the best

FEASIBILITY REPORT

BY

CII-GBC

(Confederation of Indian Industries – Green Business center)

BENEFITS OF GREEN BUILDING

- **Tangible benefits**
  - **20-30 % reduction in energy consumption**
  - **30-40 % of reduction in potable water consumption**
- **Intangible benefits:**
  - **Green corporate image**
  - **Health and safety of the building occupants**
  - **Enhanced occupant comfort**
  - **Imbibe best operating practices**
  - **Incorporate latest technologies**

LEED-INDIA Rating System

Rating	No. of points Max 69	No. of points (2011) Max 110
LEED Certified	26-32	40-49
LEED Certified Silver level	33-38	50-59
LEED Certified Gold Level	39-51	60-79
LEED Certified Platinum Level	52-69	Above 80

Findings of the Feasibility study

Prerequisites

- **Sustainable Site**
  - **Erosion & Sedimentation Control**
    - Control erosion to reduce negative impacts on water and air quality
    - Design to a site sediment and erosion control plan as per National Building Codes of India (NBC) Part 10, section 1, chapter 4 – Protection of Landscape during Construction
- **Energy & Atmosphere**
  - **Fundamental Building systems commissioning**
    - Verify and ensure that fundamental building elements and systems are designed, installed and calibrated to operate as intended
  - **Minimum Energy Performance**
    - Establish minimum level of energy efficiency for the base building and systems
    - Energy design should follow draft version of **Energy Conservation Building Code (ECBC) 2006 (India)**
  - **CFC(ChloroFloroCarbons) reduction in HVAC & R(Heating Ventilation Air Conditioning & Refrigeration) equipment**

Prerequisites

- **Materials & Resources**
  - **Storage and collection of recyclables**
    - to facilitate collection, separation and disposal of waste materials generated in the building
- **Indoor Environment Quality**
  - **Minimum IAQ performance**
    - meet minimum ventilation requirements as per ASHRAE (American Society of Heating, Refrigeration and Air-conditioning Engineers) 62.1-2004, which specifies the minimum ventilation rates and indoor air quality levels
  - **Environmental Tobacco Smoke Control**
    - by declaring the entire site as “non-smoking zone” or having a dedicated smoking rooms
  - **Emission Reduction in Captive power plants**
    - Meet the minimum requirements of Central Pollution Control Board (CPCB) or local standards

Total 8 prerequisites - All can be met

- Summary of evaluation
  - Total points available : 69
  - Possible : 48
  - Doubtful : 14
  - Not possible : 07
  - Gold/Platinum rating achievable
    - Gold (39 to 51 points)
    - Platinum (52 to 69 points
- Final rating Platinum with 61 points

1. Sustainable Sites (max 13 points)

- **Credit 1: Site Selection 1**
  - give preference to those sites that do not include sensitive site elements and restricted land types
  - Qualify being a developed site properly allocated
- **Credit 2:** Development Density & Community Connectivity 1
  - give preference to urban sites with pedestrian access to a variety of services
  - Qualify being on a properly developed surrounding having variety of services near by

1. Sustainable Sites (max 13 points)

- **Credit 3: Brownfield Redevelopment 1**
  - developing a building on abandoned / idled / under-used facilities, where expansion or redevelopment is complicated.
  - Does not qualify for this point

1. Sustainable Sites (max 13 points)

- **Credit 4: Alternative Transportation 3**
  - Reduce pollution and land development impacts from automobile use
  - **4.1 :** Locate building within ½ **mile** of a commuter rail, or ¼ **mile** of 2 bus lines
  - Qualify being 2 bus lines available
  - **4.2 :** Install alternative-fuel refueling station(s) for 3% of vehicle parking capacity
  - Qualify as electric charging points planned
  - **4.3 :** Provide preferred parking for carpools or van pools for 10% of the building occupants
  - Qualify as preferred parking planned

1. Sustainable Sites (max 13 points)

- **Credit 5: Reduced Site Disturbance 2**
  - **5.1 :** On greenfield sites, limit site disturbance including earthwork and clearing of vegetation;
  - Qualify as proper barricading being planned

  - **5.2 :** Reduce the development footprint
  - Qualify as footprint is less than 50%

1. Sustainable Sites (max 13 points)

- **Credit 6: Storm water Design 2**
  - **6.1: Quantity Control**
  - Design the project site to maintain natural stormwater flows by promoting infiltration
  - Qualify as RWH (Rain Water Harvesting) being planned

  - **6.2: Quality Control**
  - Required to design the storm water drainage system such that 80% of average annual TSS (total Suspended Solids) are removed.
  - Qualify as RWH being planned

1. Sustainable Sites (max 13 points)

- **Credit 7: Heat Island Effect 2**
  - **7.1: Non-Roof**
  - Qualify as more than 50% of parking spaces are planned under cover
  - **7.2: Roof**
  - Use roofing materials having a SRI (Solar Reflective Index) equal to or greater than 78 for a minimum of 75% of the roof surface
  - Qualify as roof will be covered with photo voltaic cell or treated with china mosaic tile

1. Sustainable Sites (max 13 points)

- **Credit 8: Light Pollution Reduction 1**
  - Adopt site lighting criteria to maintain safe light levels while avoiding
    - off-site lighting and
    - night sky pollution
  - Lux levels for exterior lighting should not exceed IESNA (Illuminating Engineers Society of North America) standards. No light to be directed towards the night sky
  - Considered doubtful but can be achieved with proper design
- Total point got 12

2. Water Efficiency (max 6 points)

- **Credit 1 : Water Efficient Landscaping** 2
  - Limit or eliminate the use of potable water for landscape irrigation.
    - By 50% : 1 points
    - By 100% : 2 points
  - Qualify by
    - appropriate landscape types and design
    - Use high efficiency irrigation systems
    - reuse of stormwater or graywater volumes for irrigation.

2. Water Efficiency (6 points)

- **Credit 2 : Water Efficiency in Air-conditioning System 1**
  - Reduce potable water consumption for air-conditioning by 50%
  - Not qualified as
    - Air cooled system used
- **Credit 3 : Innovative Wastewater Technologies 1**
  - Reduce the use of municipal water for building sewage by **50%,** OR, treat **100%** of wastewater
  - Qualify as STP being planned

2. Water Efficiency (6 points)

- **Credit 4 : Water Use Reduction 2**
  - Maximize water efficiency within buildings to reduce the burden on municipal water supply and wastewater systems
    - By 20% : 1 points
    - By 30% : 2 points
  - Qualify for both points by
    - Use of Low flow fixtures,
    - occupant sensors, waterless urinals
    - reuse of stormwater or graywater
    - Electronic water meters and leak detection system

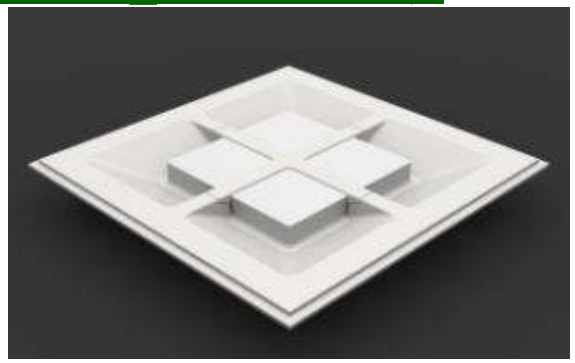
- Total point got 5

3.Energy & Atmosphere (17 points)

- **Credit 1 : Optimise energy performance 10**
  - Energy savings over and above the baseline as per **Energy Conservation Building Code (ECBC) 2006**
  - Qualify for all 10 points by
    - **Fly ash blocks for wall**
    - **Construct Wall with min U Value of U=0.1 Btu/Hr Sqft**
    - **Over deck insulation for the roof**
    - **High performance glass**
    - **Minimise fenestration area on the southern and western sides.**
    -

3.Energy & Atmosphere (17 points)

- Install T5 lamps with electronic ballasts (direct lighting)/LED to maintain lighting power density of 0.8 W/sqft
- Install daylight sensors in all permanently occupied areas
- Install occupancy sensors in toilets, baths and service rooms.
- Most Efficient VRV (Variable Refrigerant Volume) AC Units with COP of 4.85
- Solar PV and Wind mill for electric generation



3.Energy & Atmosphere (17 points)

- **Credit 2 : Renewable Energy, 3**
  - Encourage and recognise increasing levels of on-site renewable energy self-supply in order to reduce fossil fuel energy use
    - By 2.5% : 1 points
    - By 5% : 2 points
    - By 7.5% : 3 points

  - Can be achieved by use of
    - Solar / wind energy
    - Planned 40Kw + 30 Kw renewable energy

  - **Qualify 3 point & one bonus point**

3.Energy & Atmosphere (17 points)

- **Credit 3 : Additional commissioning 1**
  - done by a third party, who is not involved in building design or construction.
  - Qualify as building commissioning agent will be appointed
- **Credit 4 : Ozone depletion 1**
  - ***Reduce ozone depletion and support early compliance with the Montreal protocol***
  - Qualify by using HVAC and fire separation systems that do not contain CFC or Halons

3.Energy & Atmosphere (17 points)

- **Credit 5 : Measurement and Verification 1**
  - Provide for the ongoing accountability and optimisation of building energy and water consumption performance over time
  - Qualify as use of Building management system (BMS) and energy & water meters planned
- **Credit 6 : Green Power** 1
  - Installed green power 50 % of the total energy requirement, any where in country.
  - Will try as railway has planned green power.
- Total point got 17

3. Material & Resources (13 points)

- **Credit 1 : Building reuse** 3
  - Extend the life cycle of existing building stock
    - Maintain 75% of shell : 1 points
    - Maintain 100% of shell : 2 points
    - Maintain 100% of shell & 50% non shell : 3 points
  - Not possible as using existing rest house building not possible
- **Credit 2 : Construction waste management** 2
  - Divert waste material for reuse / recycle
    - 50% of waste : 1 points
    - 75% of waste : 2 points
  - Qualify as proper construction waste management plan will be made for reusing / recycling waste material

4. Material & Resources (13 points)

- **Credit 3 : Resource reuse** 2
  - Reuse building materials and products to reduce demand for virgin materials and to reduce waste
    - 5% reuse : 1 points
    - 10% reuse : 2 points
  - Qualify for both points by using material from rest house / existing IRICEN building or released wooden sleeper

4. Material & Resources (13 points)

- **Credit 4 : Recycled content** 2
  - Use materials with recycled content
    - 5% of value : 1 points
    - 10% of value : 2 points
  - Qualify by using flyash cement, flyash blocks, steel, recycled Aluminium, waste wooden chips, tiles, gypsum based false ceiling, etc.

4. Material & Resources (13 points)

- **Credit 5 : Local / Regional Materials** 2
  - Use locally extracted / manufactured material to support *regional economy and reducing the environmental impacts resulting from transportation*
    - 20% locally manufactured (within 800 Km) : 1 points
    - Out of this 50% extracted locally : 2 points
  - Qualify with proper selection of material
- **Credit 6 : Rapidly renewable materials 1**
  - 5% of total building materials (by cost).
  - Not qualify as good quality material specially for furnishing not available

4. Material & Resources (13 points)

- **Credit 7 : Certified Wood** 1
  - 50% of total wood used in the building should be certified by the Forest stewardship council (FSC).
  - Not qualify as availability of such wood in India is limited
- Total point got 8

5. Indoor Environmental Quality(15 points)

- **Credit 1 : Carbon-di-oxide monitoring 1**
  - install carbon-di-oxide monitoring to maintain a healthy indoor air quality
  - Qualify as being planned
- **Credit 2 : Ventilation effectiveness 1**
  - Provide for the effective delivery and mixing of fresh air to support the safety, comfort and well being of building occupants
  - 30% more than minimum as per ASHRAE Standard 62.1- 2004
  - Qualify as being planned

5. Indoor Environmental Quality(15 points)

- **Credit 3 : Construction IAQ Management Plan 2**
  - Prevent Indoor Air Quality problems resulting from the construction
  - 3.1 : **during construction** 1
    - Prevent Indoor Air Quality problems resulting from the construction
  - Qualify by making proper plan
    - to avoid dust & debris entering ductwork and working area during construction
    - Use of low VOC paints, sealants, etc. during construction or provide 100% ventilation
    - Physical barriers between work and non-work areas
    - Keeping work area as dry as possible
    - 18 Photos at various stages to show adopted measures

5. Indoor Environmental Quality(15 points)

- 3.2 : **before occupancy** 1
  - Conduct a minimum two-week building flush-out with new filtration media at 100% outside air after construction ends and prior to occupancy
  - installed,perform a building flush-out by supplying a total air volume of 14,000 cu.ft. of outdoor air per sq.ft. of floor area while maintaining an internal temperature of at least 60 degrees F and relative humidity no higher than 60%
- Qualify as same will be done

5. Indoor Environmental Quality(15 points)

- **Credit 4 : Low emitting materials 4**
  - Reduce the quantity of Indoor Air contaminants
  - Adhesive & sealants : 1 point
  - Paints : 1 point
  - Carpets : 1 point
  - Composite wood : 1 point
  - Qualify by using
    - Low Voc paints, adhesives & sealants
    - Carpet & rug industry certified carpet
    - Composite wood free from urea-formaldehyde

5. Indoor Environmental Quality(15 points)

- **Credit 5 : Indoor Chemical and pollutant source control 1**
  - Avoid exposure of building occupants to potentially hazardous chemicals that adversely impact air quality
  - Qualify by storing them separately with separate exhaust

5. Indoor Environmental Quality(15 points)

- **Credit 6 : Controllability of systems 2**
  - 6.1 Lighting 1
    - 90% of the building occupants / groups should have individual lighting controls
  - Qualify by planning uniform general lighting with task lighting combination
  - 6.2 Thermal comfort 1
    - 50% of the building occupants / groups should have individual for temperature, humidity and airflow
  - Qualify by having openable window / individual or group control

5. Indoor Environmental Quality(15 points)

- **Credit 7 : Thermal Comfort 2**
  - 7.1 **Design** 1
    - Maintain optimum temperatures as specified in ASHRAE 55-1992 i.e., 24.4^{o}C in summer and 21.7^{o}C during winter
  - Qualify by proper design of Air conditioning system
  - 7.2 **Verification 6-18 months** 1
    - Required to monitor the thermal performance of the building within a period of 6 to 18 months after occupancy
  - Qualify by agree to conduct thermal comfort survey within 6-18 months after occupancy & make correction in design if more than 20% occupants are not satisfied.

5. Indoor Environmental Quality(15 points)

- **Credit 8 : Daylight & views 2**
  - 8.1 **Daylight 75% of spaces** 1
  - Not Qualify
  - 8.2 **views for 90% of spaces** 1
  - Qualify by having proper orientation
- Total point got 14

6. Innovation & Design (5 Points)

- **Credit 1 :** Innovation & Design 4
  - – Exemplary water efficiency
    - •Reduction in potable water use (> 40 %)
  - – Eco-friendly housekeeping materials (post-occupancy)
  - – Green Education
  - – 1 or 2 other innovative ideas – to be generated as the project progresses
- **Credit 2 : LEED Accredited Professional 1**
  - –Qualify as CII-Godrej will have qualified person in his team
- •Total point Achievable 5

LEED Rating (Feb 2011)

LEED-INDIA Rating System (Feb 2011)

Rating	No. of points Max 69	No. of points (2011) Max 110
LEED Certified	26-32	40-49
LEED Certified Silver level	33-38	50-59
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Prerequisites

- **Site Selection & Planning**
  - **Construction activity pollusion control**
- **Water Efficience**
  - **Water use reduction**
- **Energy & Atmosphere**
  - **Fundamental Building systems commissioning**
  - **Minimum Energy Performance**
  - **Fundamental refrigerant management**
- **Materials & Resources**
  - **Storage and collection of recyclables**
- **Indoor Environment Quality**
  - **Minimum IAQ performance**
  - **Environmental Tobacco Smoke Control**

Total 8 prerequisites

1. Sustainable site (26)

- Site Selection (1)
  - High value form land, high hydrogeologic risk, habitat for any species listed as threatened or endangered, high ecological value, public parkland
- Density & connectivity (5)
  - 13,800 square meters per hectare net
  - Within 800 meters of a residential/ neighborhood having 10 units per 0.4 hectare net
  - Within 800 meters at least 10 basic services
- Brownfield redevelopment (1)

1. Sustainable site

- Alternative Transportation (12)
  - **Public Transportation Access (6)**
  - **Bicycle Storage and Changing Rooms (1)**
  - **Low-Emitting and Fuel-Efficient Vehicles (3)**
  - **Preferred Parking Capacity (2)**
- Site Development (2)
  - **Protect or Restore Habitat**
  - **Maximize Open Space**
- Storm water Design (2)
  - **Quantity Control**
  - **Quality Control**

1. Sustainable site

- Heat Island Effect (2)
  - **Nonroof**
    - Place a minimum of 50% of parking spaces under cover
  - **Roof**
    - Roofing with high Solar Reflectance Index (SRI)(>78)
    - China mosaic or covering with photo voltaic cell used for generating electricity
- Light Pollution Reduction (1)
  - Fixtures for outdoor lighting (no night pollution)
  - Façade lighting to have downward fixtures
  - Bollards for landscape lighting
  - low power density

2. Water efficiency (10)

- Water Efficient Landscaping (4)
  - Reduce potable water consumption for irrigation by 50%
  - **No Potable Water Use or Irrigation**
- Innovative waste water treatment & reuse (2)
- Water use reduction (4)
  - Low flow gadgets
  - Sensors to regulate flow of water
  - Electronic water meters and leak detection system

3. Energy & Atmosphere (35)

- Optimize Energy Performance (19)
  - Glazing : 30 – 40 %
  - High Performance Glass
    - Double Glazed
    - Low U value
    - High visual light transmission
  - Wall with min U Value
    - Double wall with air gap
    - Insulated wall with Fly Ash blocks

3. Energy & Atmosphere

- Roof
  - Overdeck insulation
  - China mosaic tile flooring or
  - Covered with photo voltaic cell for generating electricity
- HAVC
  - Ductable splits
    - High Efficiency chillers
    - Variable Frequency Drives (VFD) for Fans
    - Variable Air Volume (VAV) boxes

3. Energy & Atmosphere

- Low power density lighting fixtures for interior
  - T5 lamps with electronic ballasts
  - daylight sensors in all permanently occupied areas
  - occupancy sensors in toilets, baths and service rooms
- On-site Renewable energy (7)– Solar/Wind
- Enhanced Commissioning (2)
- Enhanced Refrigerant Management (2)
- Measurement and Verification (3)
- Green Power (2)

4. Materials

- Building Reuse (4)
- Construction Waste Management (2)
- Materials Reuse (2)
- Recycled content (2)
  - Like fly ash in concrete, plaster, bricks
- Regional Materials (2)
- Use of Carpet & Rug Institute (CRI) certified carpet
- Use of recycled & refurbished material
- Rapidly Renewable products (1)
- Construction waste management
- Certified Wood (1)

5. Indoor Environmental Quality(15)

- Building be declared as 'No-Smoking' area
- Outdoor air 30 % more than ASHRAE 62 (American Society of Heating, Refrigeration and Air-conditioning Engineers)
- Separate room for heavy duty copying machines, chemical mixing
- IAQ practices during construction
  - Builder to take care
- Flush out of building before occupancy
- Carbondioxide monitoring system

5. Indoor Environmental Quality

- Controllability of system
  - Lighting
  - Thermal comfort
- Low VOC (Volatile Organic Content) paints, adhesives, sealants, carpets
- Composite wood – no urea formaldehyde
- Task lighting for 90% occupants
- Daylights & views in regularly occupied areas

6. Innovation & Design (6)

- Exemplary water efficiency
  - –Reduction in potable water use (> 40 %)
- Regional materials
  - –To source > 95 % locally
- Eco-friendly housekeeping materials (post-occupancy)
- Green Education
- 1 or 2 other innovative ideas – to be generated as the project progresses

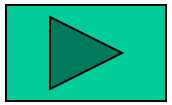
Regional Priority (4)

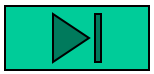
- WE c1: Water Efficient Landscaping
- WE c2: Innovative Wastewater Treatment and Reuse
- WE c3: Water Use Reduction
- EA c1: Optimize Energy Performance
- EA c3: Enhanced Commissioning
- EA c5: Measurement and Verification

Approach

- Team work
  - CII-Godrej GBC, CR Construction team ,IRICEN, Contractors, Consultants
- Role of CII-Godrej GBC
  - Catalyst, Facilitator, Handholding
  - Awareness & Training
  - Assist in documentation

What Next?

- Register project with IGBC (Indian Green Building Council)
- Appoint consultants for 
  - Facilitation
  - Energy simulation
  - Fundamental commissioning agent
- Training/Awareness
- Energy simulation
- Implementation of improvements
- Documentation by consultants, Architects team & CII
- Review by IGBC
- LEED-INDIA certification



Points for reducing energy cost(Feb 2011)

New Buildings	Existing Building Renovations	Points
12%	8%	1
14%	10%	2
16%	12%	3
18%	14%	4
20%	16%	5
22%	18%	6
24%	20%	7
26%	22%	8
28%	24%	9
30%	26%	10
32%	28%	11
34%	30%	12
36%	32%	13
38%	34%	14
40%	36%	15
42%	38%	16
44%	40%	17
46%	42%	18
48%	44%	19

Sustainable Site Planning (9,24)

- Conservation and efficient utilization of resources (7,20)
  - To maximize the conservation and utilization of resources (land, water, natural habitat, avid fauna, and energy) and
  - enhance efficiency of the systems and operations.
- Health and well being during construction (2, 4)
  - To protect the health of construction workers and prevent pollution

Conservation and efficient utilization of resources (7,20)

- **Criterion 1** Site selection (1)
  - Mandatory clause (0)
    - In conformity with the development plan/master plan/UDPFI guidelines
    - comply with the provisions of eco-sensitive zone, coastal zone, heritage areas, water body zones (no construction is permitted in the water-spread and buffer belt of 30 metre), various hazard prone area regulations etc
- *Optional clause* **(1)**
  - located within ½ km radius of an existing Public Transport and/or
  - the proposed site must be a Brownfield site

Conservation and efficient utilization of resources (7,20)

- **Criterion 2** Preserve and protect landscape (5)
  - Mandatory clause (1)
    - Preserve existing vegetation **OR**
    - Trees/plants replanted within site premises in ratio of 3:1 **(1 point – if applicable).**
  - *Optional clause* **(4)**
    - Ensure proper timing of construction **and** Confine construction activity to pre-designated areas **(1)**
    - Proper implementation of staging and spill prevention plan **and** Effective erosion and sedimentation control **(1)**
    - Preserve topsoil **(1 point, if applicable)**
    - Trees/plants replanted within site premises in excess of 25% than minimum requirement **(1)**

Conservation and efficient utilization of resources (7,20)

- **Criterion 3** Soil conservation (2)
  - Proper topsoil laying for vegetative growth **(1)**
  - Proper stabilization of soil **(1)**
- **Criterion 4** Design to include existing site features (4)
  - Layout the site activities and building requirements after carrying out detailed site analysis so as to ensure sustainable site development in tune with its topographical, climatic, and ecological character.

Conservation and efficient utilization of resources (7,20)

- **Criterion 5** Reduce hard paving and/or provide shaded hard-paved surfaces (2)
  - Mandatory clause (1)
    - Surface parking within as per local by-law **(mandatory) AND**
    - More than 50% of paved area to have pervious paving/open-grid pavement/grass pavers **OR**
    - Minimum 50% of paved area to have shading by vegetated roof **OR** topped with solar reflectance of 0.5 or higher **OR** any combination
  - Optional clause **(1)**
    - Net paved area under parking, roads etc not to exceed 25% **OR**
    - Imperviousness factor should not exceed , as prescribed by NBC 2005 whichever is more stringent

Conservation and efficient utilization of resources (7,20)

- **Criterion 6** Enhance outdoor lighting efficiency and use renewable energy for outdoor lighting (3)
  - Luminous efficacy of 100% of lamps used in outdoor lighting to meet the corresponding lamp luminous efficacy as mentioned in Table 6.1, as per GRIHA **(1)**
  - Automatic controls for 100% of outdoor lights **(1)**
  - 25% of total number or 15% of total connected load of outdoor lighting fixtures with solar lighting system **(1)**

Conservation and efficient utilization of resources (7,20)

- **Criterion 7** Plan utilities efficiently and optimize on-site circulation efficiency (3)
  - Minimize transportation/service corridors and shading of pedestrian roads **(1)**
  - Use of aggregate utility corridors **(1)**
  - Consolidation of utility corridors along the previously disturbed areas or along new roads **(1)**

Health and well being(2,4)

- **Criterion 8** Provide minimum level of sanitation/safety for construction workers (2)
  - Mandatory clause (2)
    - Compliance with National Building Code norms on construction safety **(1)**
    - Minimum health and sanitation facilities ie clean drinking water, adequate decentralised latrines & urinals **(1)**
- **Criterion 9** Reduce air pollution during construction (2)
  - Mandatory clause (2)
    - use of air pollution preventive measures **(2)**

Building Planning & Construction(22, 74)

- **Conservation and efficient utilization of resource(16, 64)**
  - maximize resource (water, energy, and materials) and enhance efficiency of system and operations
    - **Water(3, 6)**
    - **Energy: end use(2, 24)**
    - **Energy: embodied and construction(3, 14)**
    - **Energy: renewable(2, 8)**
    - **Recycle, recharge, and reuse of water(2, 7)**
    - **Waste management(4, 5)**
- **Health and well-being of occupants (6, 10)**
  - To ensure healthy indoor air quality, water quality, and noise levels, and to reduce the global warming potential

Conservation and efficient utilization of resources (16,64) – water (3,6)

- **Criterion 10** Reduce landscape water requirement (3)
  - By 30% **(1)**
  - By 40% **(additional 1 point)**
  - By 50% **(additional 1 point)**
- **Criterion 11** Reduce water in building (2)
  - By 25% **(1)**
  - By 50% **(additional 1 point)**
- **Criterion 12 E**fficient water use during const (2)
  - Efforts to minimize potable water use for construction **(1)**

Conservation and efficient utilization of resources (16,64) – Energy: end use (2,24)

- **Criterion 13** Optimize building design to reduce conventional energy demand (8)
  - Mandatory clause (6)
    - Appropriate planning which reflects climate responsiveness (**2)**
    - Adequate day lighting is provided **(2)**
      - **>25% living area have day light**
    - Over-design of lighting system is avoided **(2)**
  - Optional clause (2)
    - Increase in daylighted area **(2)**
      - **>50% living area have day light (Additional 1 point)**
      - **>75% living area have day light (Additional 1 point)**

Conservation and efficient utilization of resources (16,64) – Energy: end use (2,24)

- **Criterion 14** Optimize energy performance of building within specified comfort limits (16)
  - Mandatory clause (8)
    - Compliance with Energy Conservation Building Code 2007 **(6)**
    - Thermal comfort condition as per National Building Code 2005 and minimum benchmark index as per GRIHA **(2)**
      - **Air condition area 100%**
      - **Non air condition area**
        - » **60% for warm & humid climate condition**
        - » **90% for other climate condition**
  - Optional clause (8)
    - Every 10% reduction in EPI of the building shall fetch additional 2 points to a maximum of 8 points. **(2–8 points)**

Conservation and efficient utilization of resources (16,64) – Energy: embodied and construction (3,14)

- **Criterion 15** Utilization of fly-ash in building structure (6)
  - Minimum 15% replacement of cements with fly-ash (by weight of cement used) in structural concrete (**1)**
  - **(additional 1 point if more than 30%)**
  - Minimum 40% usage of fly-ash (by volume of materials used), for 100% load-bearing & no-load bearing walls (**2)**
  - Minimum 30% replacement of cement with fly-ash (by weight of cement used) in plaster/masonry mortar (**2)**

Conservation and efficient utilization of resources (16,64) – Energy: embodied and construction (3,14)

- **Criterion 16** Reduce volume, weight, and const time by adopting efficient technologies (such as pre-cast systems) (4)
  - Structural application: Use of low-energy materials/efficient technologies clearly demonstrating a minimum 5% reduction in the embodied energy (2)
  - Non-structural application: Use of low-energy materials/efficient technologies clearly demonstrating a minimum 5% reduction in the embodied energy (2)

Conservation and efficient utilization of resources (16,64) – Energy: embodied and construction (3,14)

- **Criterion 17** Use low-energy material in interior (4)
  - Sub-assembly/internal partitions/panelling/false ceiling/in-built furniture **(2)**
  - Flooring **(1)**
  - Doors/windows and frames **(1)**

Conservation and efficient utilization of resources (16,64) – Energy: renewable (2,8)

- **Criterion 18** Renewable energy utilization (5)
  - Mandatory clause
    - Equal to or more than 1% of internal lighting and space conditioning connected loads in the building **(1)**
  - Optional clause
    - Equal to or more than 5% of internal lighting consumption **(1)**
    - Equal to or more than 10% of internal lighting consumption **(2)**
    - **E**qual to or more than 20% of internal lighting consumption **(3)**
    - **E**qual to or more than 30% of internal lighting consumption **(4)**

Conservation and efficient utilization of resources (16,64) – Energy: renewable (2,8)

- **Criterion 19** Renewable-energy-based hot water system (3)
  - 20% to 50% of annual energy required for water heating is saved **(1)**
  - 50% to 70% of annual energy required for water heating is saved **(2)**
  - More than 70% of annual energy required for water heating is saved **(3)**

Conservation and efficient utilization of resources (16,64) – Recycle, recharge or reuse of water (2,7)

- **Criterion 20** Waste water treatment (2)
  - Treated water met disposal/reuse application standard **(2)**
- **Criterion 21** Water recycle and reuse (5)
  - Mandatory clause (if applicable)
  - Adequate preventative measures to avoid contamination of aquifer by the recharged rainwater
  - Optional clause
    - Annual water reuse of 25% **(1)**
    - Annual water reuse of 50% **(additional 1 point).**
    - Annual water reuse of 75% **(additional 1 point).**
- Recharge of surplus rainwater into aquifer **(2)**

Conservation and efficient utilization of resources (16,64) – Waste management(4,5)

- **Criterion 22** Reduce waste during construction (1)
  - Segregation of inert and hazardous wastes **and**
  - Recycling and safe disposal of segregated wastes **(1)**
- **Criterion 23** Efficient waste segregation (1)
  - Multi-coloured bins for waste segregation at source**(1)**
- **Criterion 24** Storage and disposal of wastes (1)
  - Space for hygienic storage of segregated waste **(1)**
- **Criterion 25** Resource recovery from waste (2)
  - Zero waste generation through appropriate resource recovery measures (2)

Health and well being(6,10)

- **Criterion 26** Use low-VOC paints /adhesives /sealants (3)
  - Zero/low-VOC paints (1)
  - Low-VOC sealants and adhesives (1)
  - No urea–formaldehyde resins in composite wood (1)
- **Criterion 27** Reduce ozone depleting substances (2)
  - Mandatory clause (1)
    - Insulation used in building is chloro fluoro carbon (CFCs) and hydro chloro fluoro carbon(HCFCs) free **and**
    - HVAC and refrigeration equipment are CFCs free **and**
    - Fire suppression systems and fire extinguishers are free of halon **(1)**

Health and well being(6,10)

- **Criterion 28** Ensure water quality (2)
  - Mandatory clause (2)
    - Water quality conforming to IS standards **(2)**
- **Criterion 29** Acceptable outdoor and indoor noise levels (2)
  - The outdoor noise levels are within limits set by Central Pollution Control Board(CPCB). Environmental Standards–Noise (ambient standards), as per GRIHA **(1)**
  - The indoor noise levels are within the acceptable limits as set in NBC 2005 (BIS 2005a) **(1)**

Health and well being(6,10)

- **Criterion 30** Tobacco smoke control (1)
  - Mandatory clause (1)
    - The company policy for ban/prohibition of smoking within the building premises **(1**
- **Criterion 31** Provide at least the minimum level of accessibility for persons with disabilities (1)
  - Compliance with National Building Code norms on requirements for planning of public buildings meant for use of physically challenged **(1)**

Building operation and maintenance (2,2)

- **Criterion 32** Energy audit and validation (0)
  - Mandatory clause (0)
    - Energy audit report by an energy auditor approved by the BEE
- **Criterion 33** Operation and maintenance (2)
  - Mandatory clause (2)
    - Provision of meters for monitoring building's energy and water consumption (1)
    - A core facility/service group responsible for the O&M of the building's systems after installation providing training to them **and**
    - Development of a fully documented O&M manual/ CD/ Multimedia /information brochure enlisting the best practices for O&M of the building's systems (1)

Innovation(1,1)

- **Criterion 34 Innovation points** (1)
  - Additional points above 100 points
  - Four innovation points are available under the rating system for adopting criteria which enhances the green intent of a project
  - Some of the probable points are as follows
    - alternative transportation
    - environmental education
    - company policy on green supply chain
    - life cycle cost analysis
    - any other criteria proposed by applicant

THANK YOU