



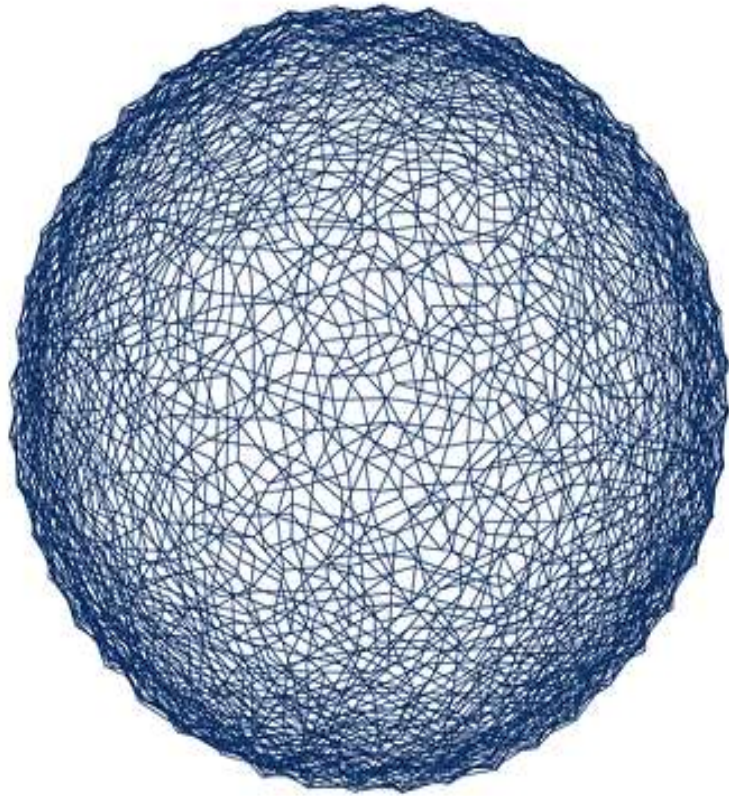
Ar. Poorva Keskar

LEED AP, GRIHA Evaluator and Trainer

Director, Vke : environmental

Principal, Brick School of Architecture

GREEN BUILDING RATING SYSTEMS



COP15 COPENHAGEN

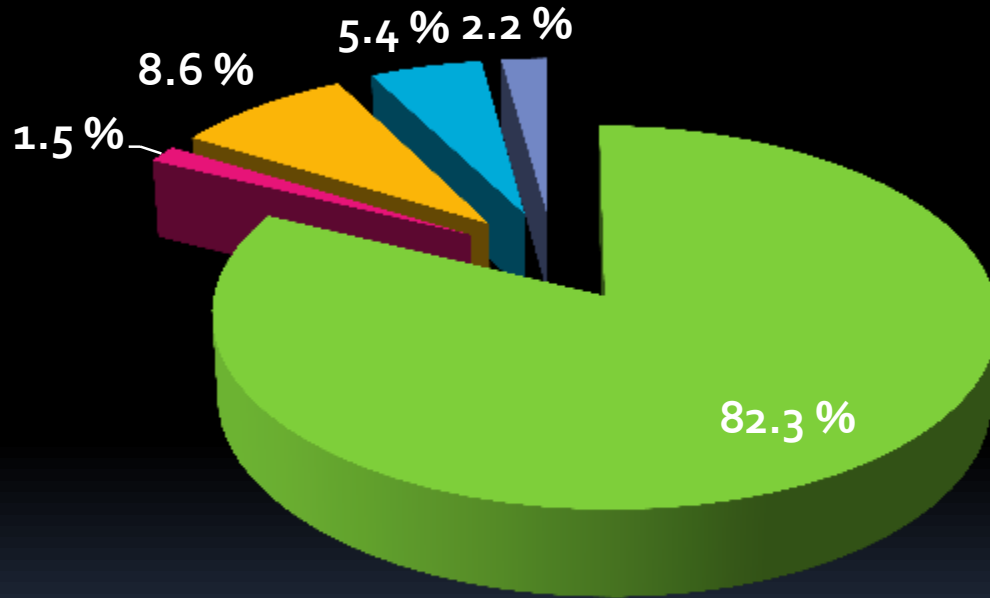
UN CLIMATE CHANGE CONFERENCE 2009



The Unit of Carbon

- Action towards Climate Change made it necessary to derive a **SINGLE UNIT** to measure the **IMPACT** of Human Activities on Earth's Environment (temperatures)
- Scientific enquiry ascertained that **C** from various sources, primarily from **COMBUSTION** of **FOSSIL FUELS**, was largely responsible for increasing temperatures

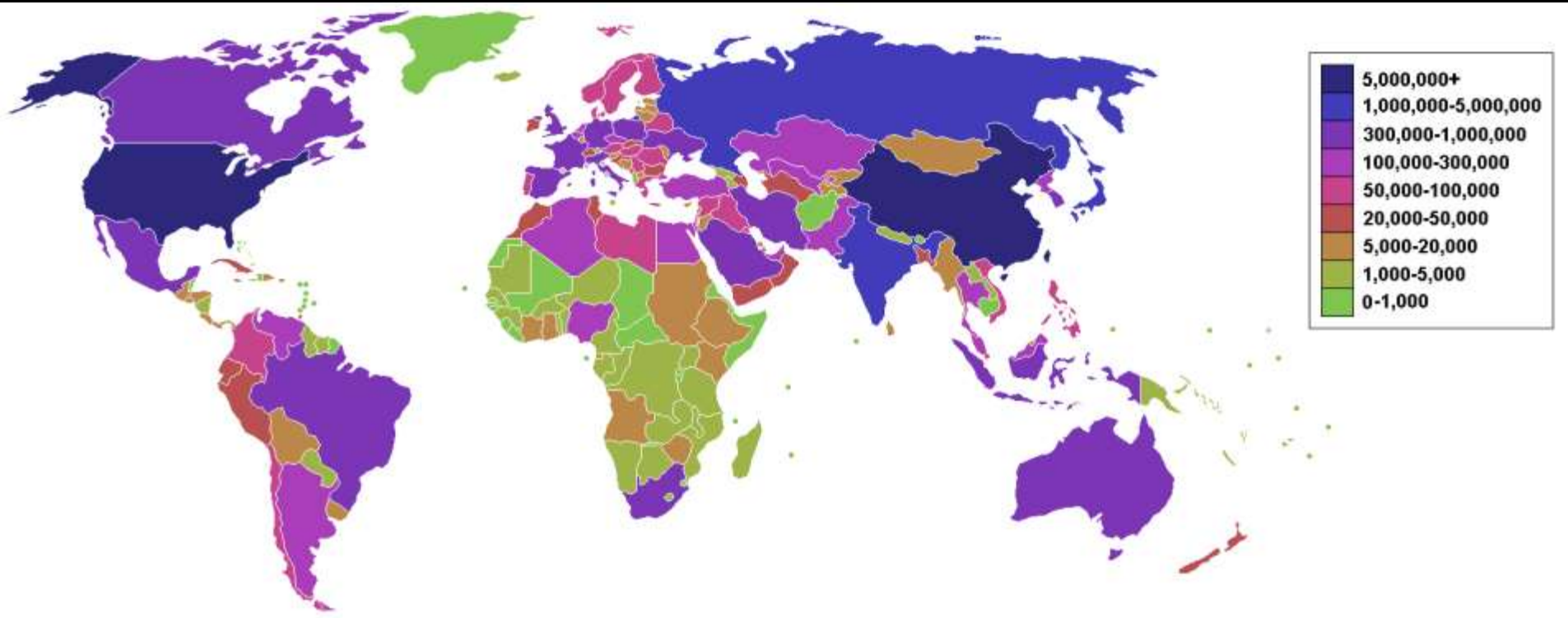
The Unit of Carbon



Species	Chemical formula	GWP ₁₀₀
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298
HFCs	-	124 - 14800
Sulphur hexafluoride	SF ₆	22800
PFCs	-	7390 - 12200

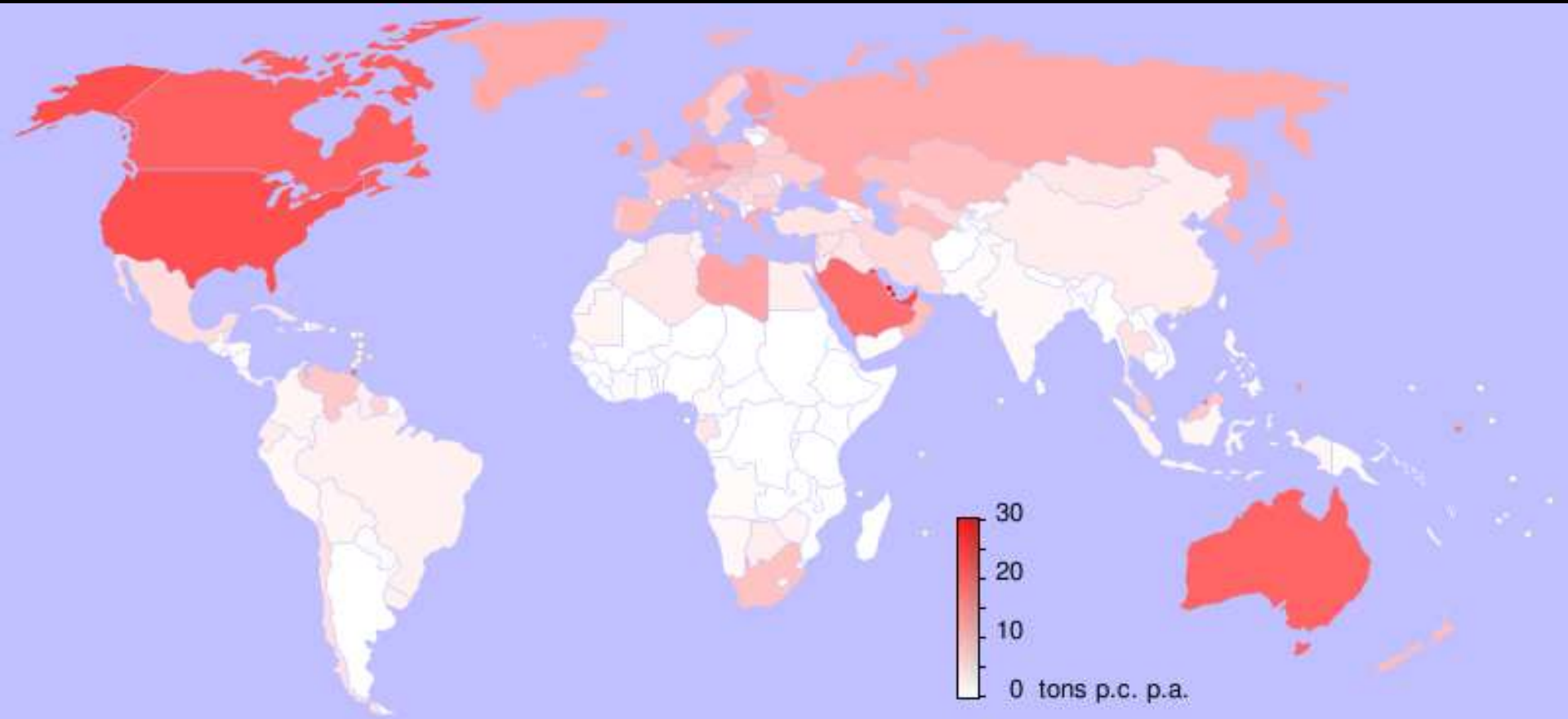
- Energy Related CO₂
- Other CO₂
- Methane
- Nitrous Oxide
- HFCs, PFCs, SF₆

NAPCC



World Carbon dioxide Emissions

NAPCC



World per capita Carbon dioxide Emissions

Energy Consumption and GHG Emissions



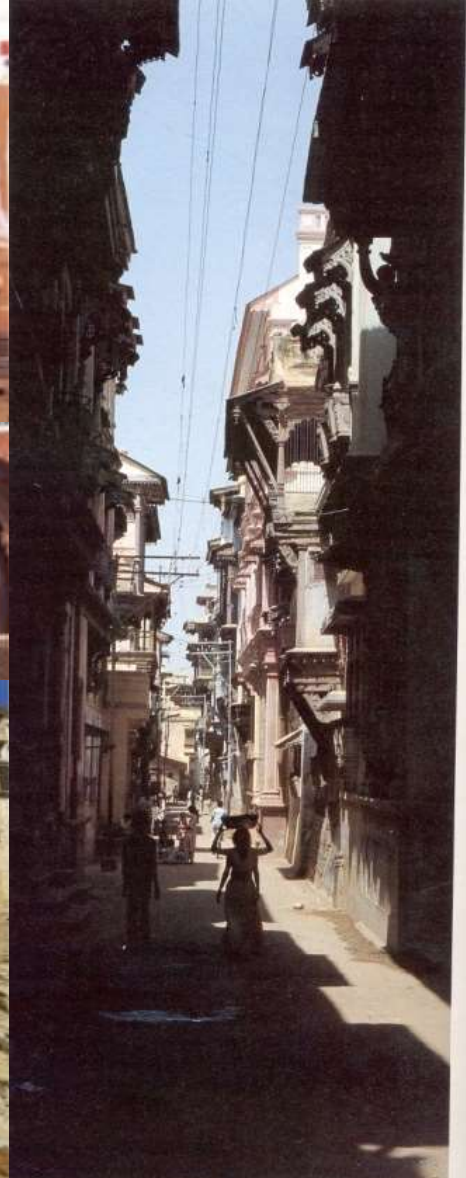
Economic Growth

NAPCC

Mission	Objective	Responsible Entity
<i>National Solar Mission</i>	<ul style="list-style-type: none"> 20,000 MW of solar power by 2020 	Ministry of New & Renewable Energy
<i>National Mission for Enhanced Energy Efficiency</i>	<ul style="list-style-type: none"> 10,000 MW of EE savings by 2020 	Ministry of Power
<i>National Mission for Sustainable Habitat</i>	<ul style="list-style-type: none"> EE in residential and commercial buildings, public transport, Solid waste management 	Ministry of Urban Development
<i>National Water Mission</i>	<ul style="list-style-type: none"> Water conservation, river basin management 	Ministry of Water Resources
<i>National Mission for Sustaining the Himalayan Ecosystem</i>	<ul style="list-style-type: none"> Conservation and adaptation practices, glacial monitoring 	Ministry of Science & Technology
<i>National Mission for a Green India</i>	<ul style="list-style-type: none"> 6 mn hectares of afforestation over degraded forest lands by the end of 12th Plan 	Ministry of Environment & Forests
<i>National Mission for Sustainable Agriculture</i>	<ul style="list-style-type: none"> Drought proofing, risk management, agricultural research 	Ministry of Agriculture
<i>National Mission on Strategic Knowledge for Climate Change</i>	<ul style="list-style-type: none"> Vulnerability assessment, Research & observation, data management 	Ministry of Science & Technology

Missions focused on 'Mitigation'
 Missions focused on 'Adaptation'

What *has this to do with the
projects we build
today?*



Precedent.....

Precedent

Form generated from

- ✓ Climate
- ✓ Function
- ✓ Availability of materials
- ✓ Culture

Respecting Nature !



Modern Movement

Modern Movement

Form generated from

- ✓ Technology to serve man
- ✓ Urbanization

Controlling Nature !!



Present

Contemporary Architecture

Form generated from

- ✓ “WANT” and not the “NEED”
- ✓ Ultra Urbanization

Exploiting Nature !!

The Changed Outlook

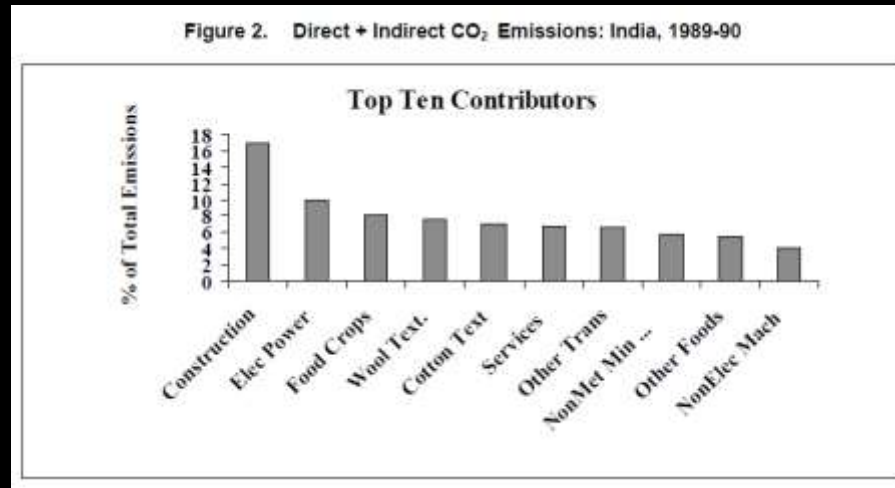
Achieve comfort without

- ✓ Damaging the Ecology
- ✓ Exploiting the Natural Resources

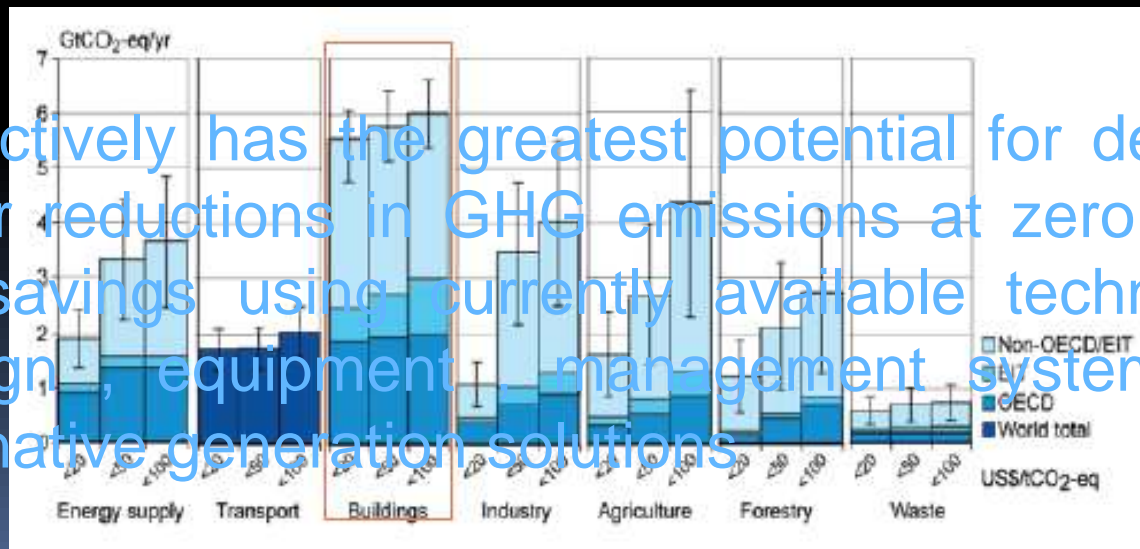
- ✓ Demand Less
- ✓ Optimize Use

Green Buildings aim to create comfort for its users but not at the cost of environment.

Why Construction Sector



Collectively has the greatest potential for delivering major reductions in GHG emissions at zero cost or net savings using currently available technologies, design, equipment management systems, and alternative generation solutions.





slide



The ACROS Fukuoka-Japan

How
Green
are these
buildings?

Bahrain World Trade Center



KFW Tower



How to Weigh our project footprint



Can we measure the greenness of a building?

Green Building Rating systems can qualitatively and quantitatively rate the buildings on the degree of their "Greenness"

Evaluates the building over its life cycle for

- ✓ *Resource Consumption*
- ✓ *Minimal environmental footprint*
- ✓ *Health and wellbeing of the occupants.*

Green Buildings

Sustainable Site

Climate Responsive
Architecture

App Materials
& Technologies

Water Management

Waste Management

Energy Management

Waste Management



Sustainable Sites

Ecological Site planning which looks beyond the boundary wall to achieve

- ✓ Biodiversity Conservation
- ✓ Reduction in Soil Erosion
- ✓ Water Management
- ✓ Reduction in land, water and air pollution
- ✓ Urban Heat Island reduction



Water Efficiency

- ✓ Water use reduction
- ✓ Reduction in Potable Water usage
- ✓ Reuse and Recycling of water, especially for secondary uses
- ✓ Water Efficient Landscaping



Energy And Atmosphere

Climate Responsive Architecture

Building systems commissioning

CFC Reduction in HVAC equipment

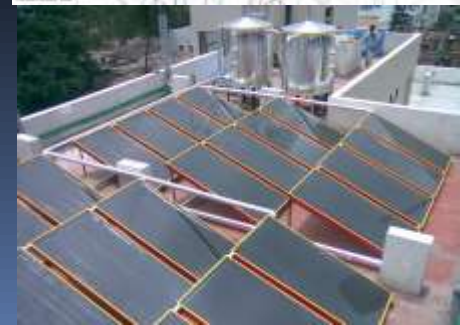
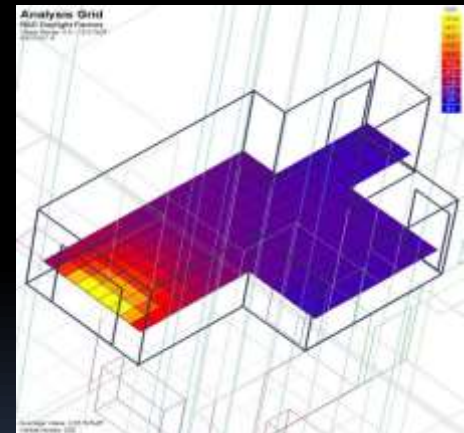
Energy Performance

On-site renewable energy

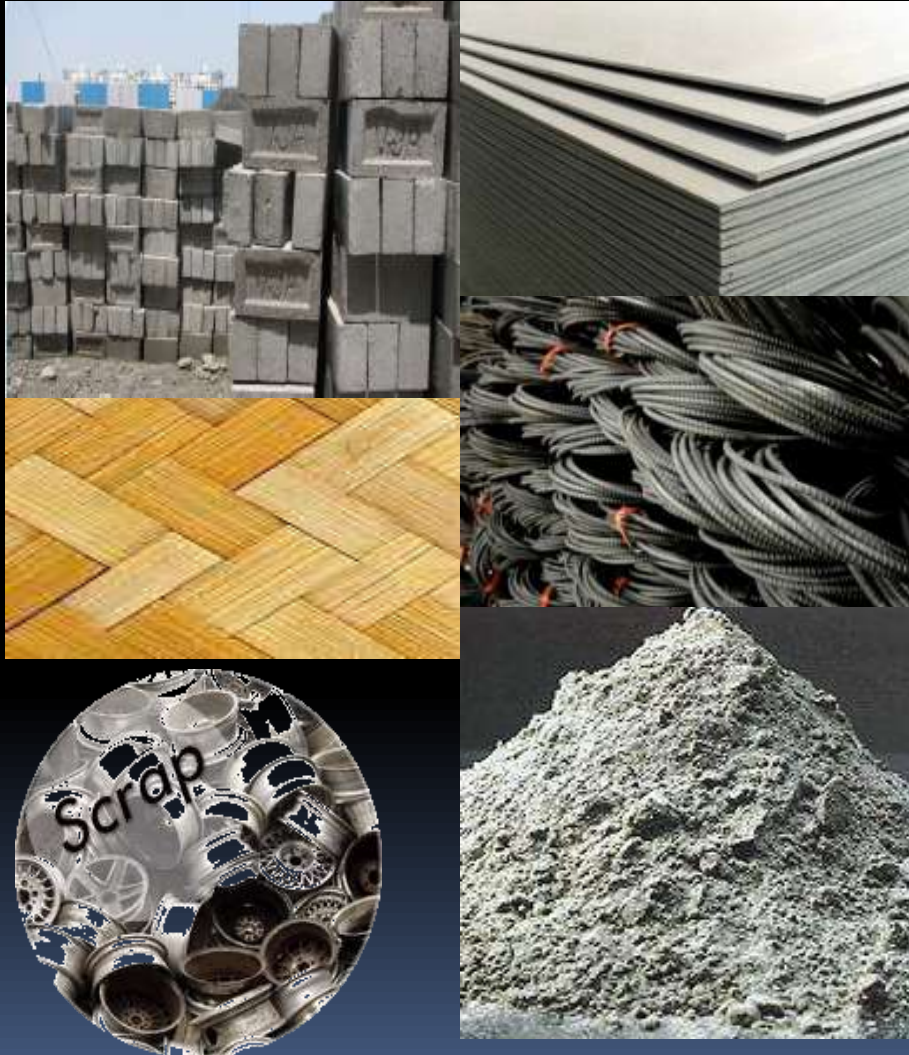
Ozone depletion

Measurement and Verification

Green Power



Materials And Resources



Storage and collection of
recyclables

Reuse of Building components

Construction waste management

Resource Reuse

Recycled content

Local Materials

Rapidly renewable materials

Indoor Environment Quality Health & Well being



Good Ventilation practices as per NBC and ASHRAE

Environmental Tobacco smoke control

Low emitting materials – adhesives, paints, carpets, finishes etc



Controllability of systems – lighting and thermal

Thermal comfort and Daylight

Health of the workers on site



Global Overview



Green Building Rating Systems- Cumulative Energy Assessment Systems

Rating systems in the world:

- ❖ LEED-US
- ❖ BREAM
- ❖ CASBEE
- ❖ GREEN STAR
- ❖ GREEN GLOBE
- ❖ ESTIDAMA-Pearl
- ❖ BCA Green Mark

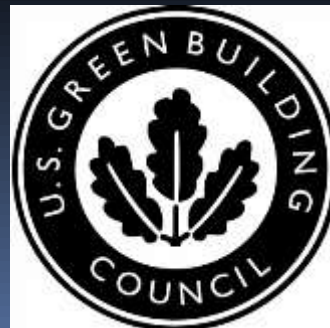
Rating systems in India:

- ❖ LEED-India
- ❖ GRIHA
- ❖ ECOHOUSING

LEED-US

- Countries: United States
- Developed by:
US Green Building Council (USGBC)
- 6 categories under LEED-US

Source: www.usgbc.org





LEED® for New Construction

Total Possible Points 110***

 Sustainable Sites	26
 Water Efficiency	10
 Energy & Atmosphere	35
 Materials & Resources	14
 Indoor Environmental Quality	15

* Out of a possible 100 points + 10 bonus points

** Certified 40+ points, Silver 50+ points,
Gold 60+ points, Platinum 80+ points

 Innovation in Design	6
 Regional Priority	4

LEED-US

LEED certified buildings aim at achieving:

- Lower operating costs and increase asset value
- Reduce waste sent to landfills
- Conserve energy and water
- Be healthier and safer for occupants
- Reduce harmful greenhouse gas emissions
- Qualify for tax rebates, zoning allowances and other incentives in hundreds of cities

BREAM (BRE Environmental Assessment Method)

Countries: UK, Europe and Gulf

Considers all areas of 'Sustainability' i.e.
Economic, Environmental and Social.

Energy

Dwelling Emission Rate
Building envelope performance
Lighting

Transport

Pollution

Reduction of surface runoff
Renewable and Low Emission Energy Source

Materials

Responsible sourcing of Materials

Water

Potable Water Use

Land Use and Ecology

Protection of ecological features
Building footprint

Health and Well Being

Day lighting

Management

Home User Guide
Considerate Constructors



GREEN STAR

Countries: Australia

Developed by: Green Building Council, Australia

9 categories under Green Star:

- ◆ Management
- ◆ Indoor Environmental Quality
- ◆ Energy
- ◆ Transport
- ◆ Water
- ◆ Materials
- ◆ Land use and ecology
- ◆ Emissions
- ◆ Innovation

Certification Level	Stars	Points
Best Practice	4 Star	45-59
Australian Excellence	5 Star	60-74
World Leaders	6 Star	75-100



green building council australia
MEMBER

CASBEE

(Comprehensive Assessment System for Built Environment Efficiency)

Countries: Japan

Developed by: Institute of Building Environment and Energy Conservation

CASBEE was developed as a simple system to enhance incentives to designers and others, having wide range of applications and address issues and problems peculiar to Japan and Asia.

4 Categories under CASBEE:

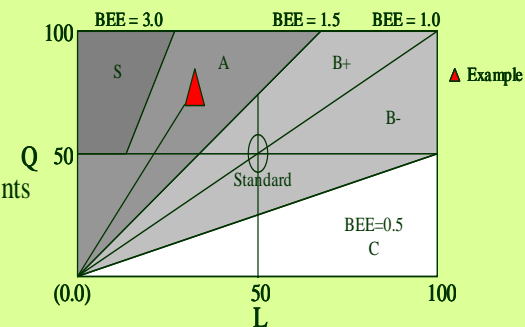
- ◆ Energy Efficiency
- ◆ Resource Efficiency
- ◆ Local Environment
- ◆ Indoor Environment

• Building Environmental Efficiency (**BEE**)

$$= \frac{\text{Building Environmental Quality (Q) \& Performance}}{\text{Building Environmental Loadings (L)}}$$

BEE values are represented on the graph by the gradients of the lines connecting the assessment results and the origin (0,0)

The larger the gradient, the more sustainable.



The larger the gradient, the the more sustainable.

GREEN GLOBES

Countries: USA and Canada

Developed by: Green Building Initiative
(in USA) and Building Owners and
Managers Association of Canada
(BOMA in Canada)

7 Categories under Green Globes:

- ◆ Energy
- ◆ Indoor Environment
- ◆ Site
- ◆ Water
- ◆ Resources
- ◆ Emissions
- ◆ Project/ Environmental Management

ESTIDAMA-PEARL

Countries: Abu Dhabi, UAE

Developed by: Pearl Design Systems (PDS) and Abu Dhabi Urban Planning Council

8 CATEGORIES under Estidama:

- ◆ Biodiversity index
- ◆ Water use per person
- ◆ Energy use per person
- ◆ Mobility index
- ◆ Carbon footprint
- ◆ Education index
- ◆ Health index
- ◆ Household waste



استدامة
estidama

Guidelines, Procedures and Certifications

MoEF Environmental Clearances – EIA and EMP

LEED (Leadership in Energy and Environmental Design)

GRIHA (Green Rating for Integrated Habitat Assessment)

ECBC (Energy Conservation Building Codes)

Eco Housing Guidelines

Griha: Green Rating for Integrated Habitat Assessment

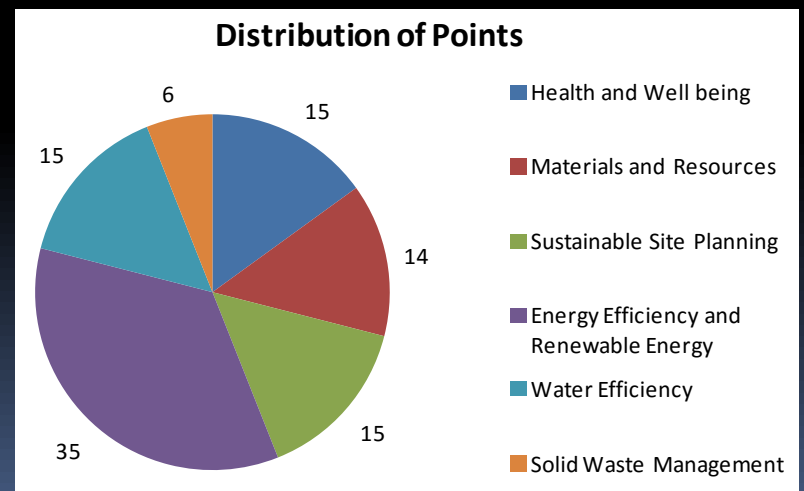


Developed by TERI and supported by Ministry of New and Renewable Energy

The measures are listed in 34 criteria and considers post occupancy monitoring and auditing as a mandatory criteria to offer certification.

Commercial buildings have to use minimum renewable energy of 1%

Points scored	Rating
50-60	One star
61-70	Two stars
71-80	Three stars
81-90	Four stars
91-100	Five stars



Indian Green Building Council (LEED-INDIA)

- Countries: India
- Developed by: Indian Green Building Council (IGBC)
- 5 categories under LEED-India
 - ❖ Sustainable site development
 - ❖ Water savings
 - ❖ Energy efficiency
 - ❖ Materials selection and
 - ❖ Indoor environmental quality



Certification Level	Points
Certified	26 to 32
Silver	33 to 38
Gold	39 to 51
Platinum	52 or more

Indian Green Building Council Green Homes

Following categories of dwelling can apply for IGBC Green Homes:

1. Individual Homes.
2. Gated Communities.
3. High rise residential apartment.
4. Existing residential Building.
5. Residential building with major renovation.
6. Hostels, service apartments, Resort, Motels and Guest houses.

Certification Level	Points for projects with Interiors	Points for projects without Interiors
Certified	32 - 39	30 – 36
Silver	40 - 47	37 – 44
Gold	48 - 59	45 – 55
Platinum	60 - 80	56 - 75



Green Building Case Studies



SVAGRIHA

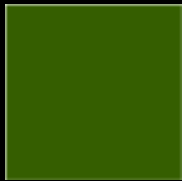
small
versatile
affordable



GREEN SPACES

Realtors

Nashik



VK:e
environmental



What SVAGRIHA includes ...

Landscape

Energy

Water and

Waste

Materials

25 to 30 points



31 to 35 points



36 to 40 points



41 to 45 points



45 to 50 points



Criterion Name	Point available
Reduce Exposed, Hard paved surface on site and maintain native vegetation cover on site	6
Passive Architectural Design Systems	4
Good Fenestration Design for reducing direct heat gain and glare while maximizing day light penetration	6
Efficient Artificial Lighting System	2
Thermal Efficiency of Building Envelope	2
Use of Energy Efficient Appliances	3
Use of Renewable energy on site	4
Reduction in building and landscape water demand	5
Rainwater Harvesting	4
Generate Resource from Waste	2
Reduce embodied energy of building	4
Use Low-energy Materials in interiors	4
Adoption of green lifestyle	4
Innovation	2

The Project:

GREEN SPACES Realtors

Nashik

SvaGRIHA Rated

1st in Maharashtra

3rd in India





The Team



The Developer : Mr. Kiran Chavan, Mr. Tejas Chavan

Architect: Ar. Sanjay Patil from Environ Planners

Structural Consultant: Mr. Shah, Environ Planners

MEP Consultant: Milind Services Consultants Pvt. Ltd.

Landscape Consultant: Roots Design

Environmental and Energy Consultant: VK:e
environmental



The Project

- G + 2 Office Building
- Offices are planned on the Ground and First Floor; while the second floor is partly occupied with a multipurpose hall
- The Office Buildings stands on a previously developed site.
- Designed for an occupancy of 32 people



- Site area: 254.68 sqm
- Built up area: 253 sqm
- Location: Off College Road, Nashik

The Architecture

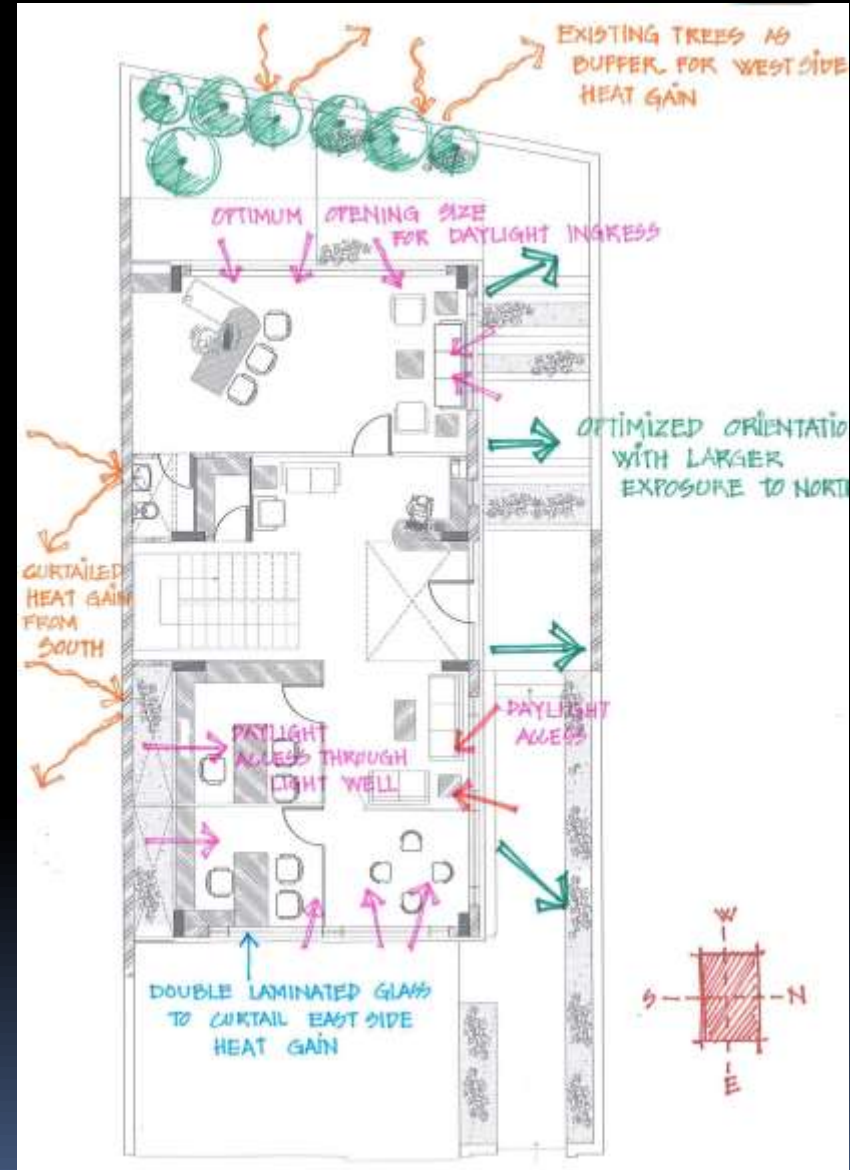
1. Space Planning
2. Natural Day Lighting
3. Natural Ventilation
4. Envelope Design
5. Site landscape



The Architecture

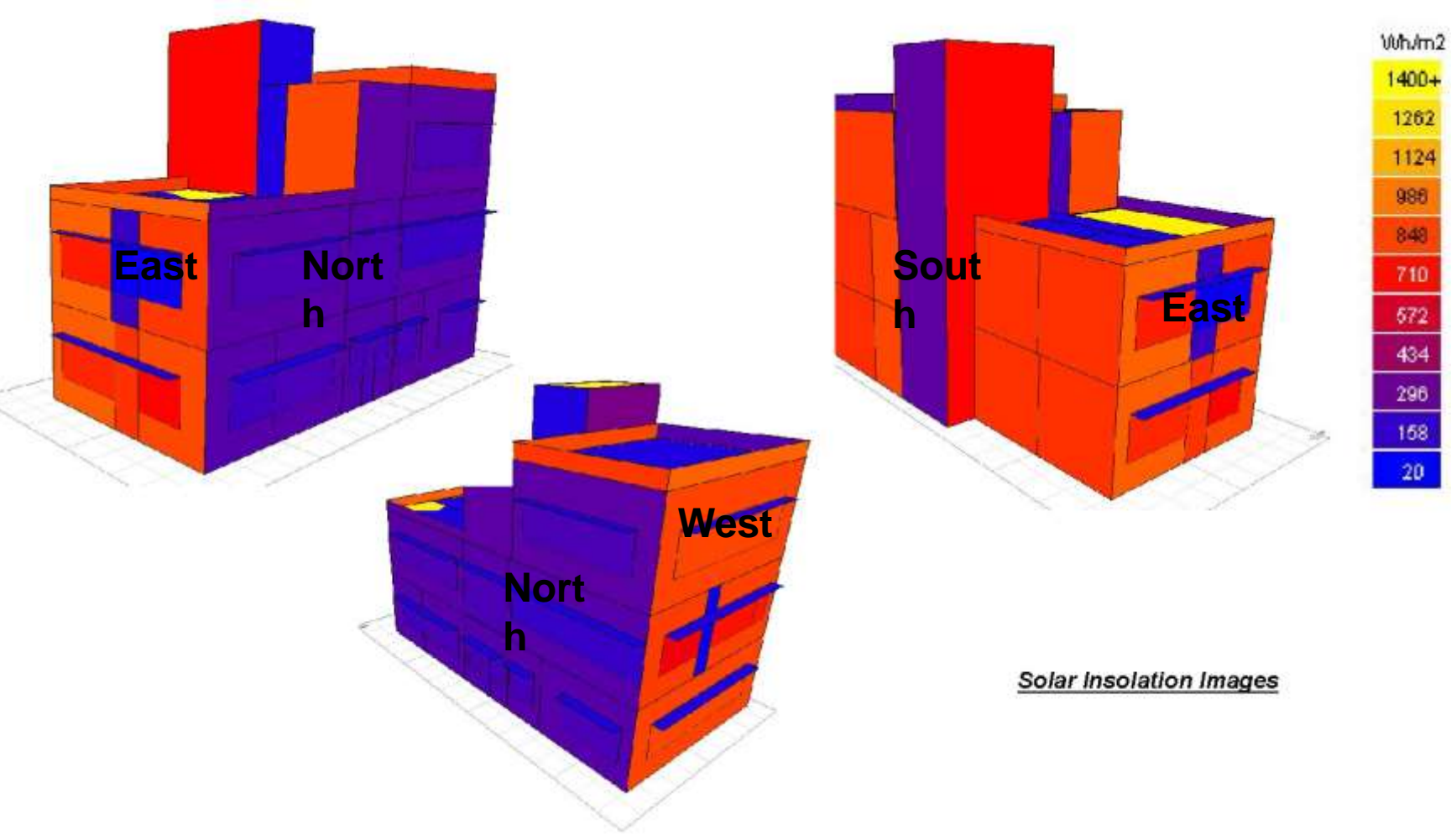
Space Planning

- Very small site hence constraints for openings
- Orientation – Along E-W Axis with Longer Façade to the North
- Functional Spaces towards building periphery to receive natural day light



The Architecture

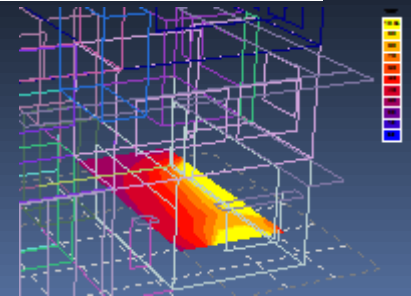
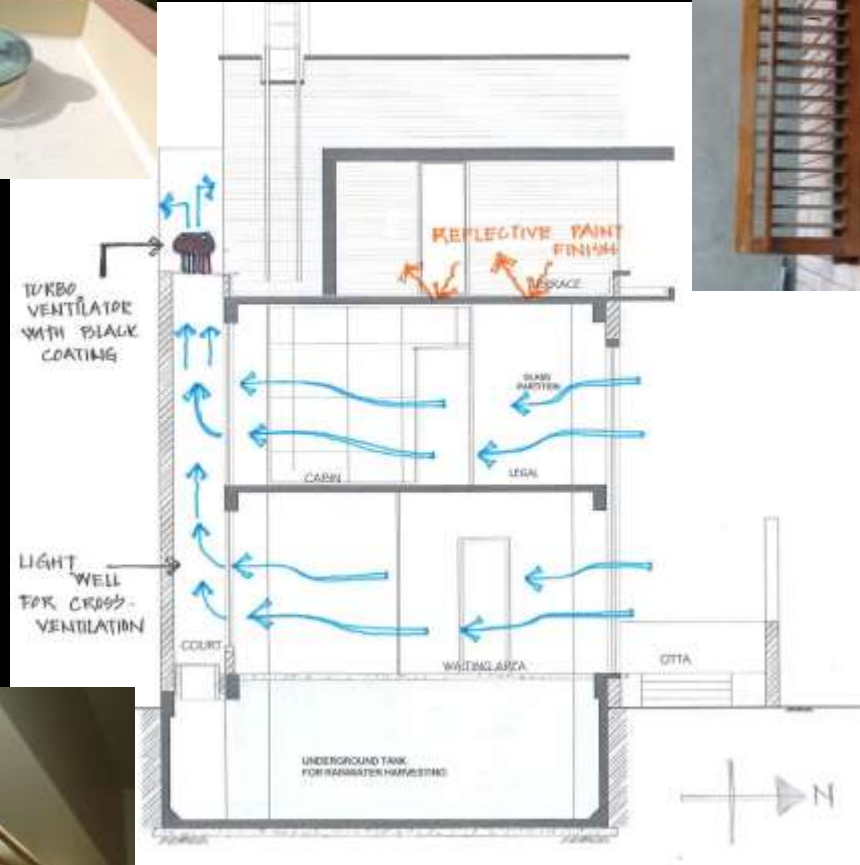
Solar Insolation



The Architecture



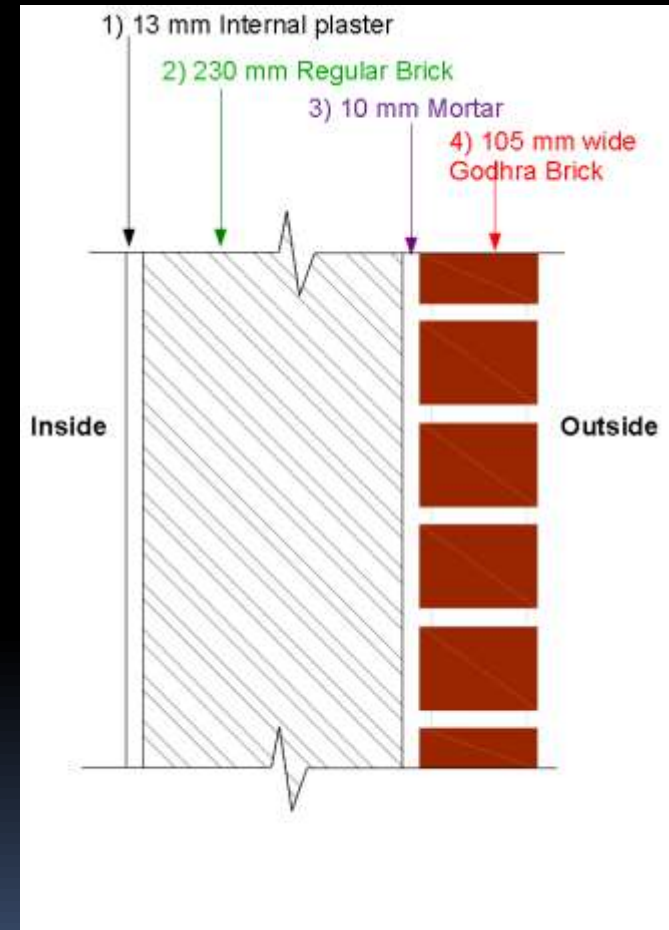
- Natural Day light and Ventilators
- Skylights – for uniform light distribution
- Light Well – day light where windows cannot be provided
- Turbo Ventilators – To induce air flow, stacks have been painted black to act like a solar chimney. The air shall be exhausted from the ventilators
- Dedicated Vertical Louvers for Ventilation - To draw in fresh air



The Architecture

Envelope Design

- U Value of External Walls = 1.6 W/Sq m deg K – The double walling facilitates lower heat gain from the building envelope
- U Value of Roof = 1.9 W/Sq m deg K – Conventional RCC Roof with Terracota tiles finished with high SRI paint.
- SHGC of Glazed Windows and Shading = 0.4 – Glazing is completely shaded on account of local shading devices and proper orientation
- The facades are in shade due to optimum orientation and shading due to existing trees on site.



The Architecture

Site Landscape

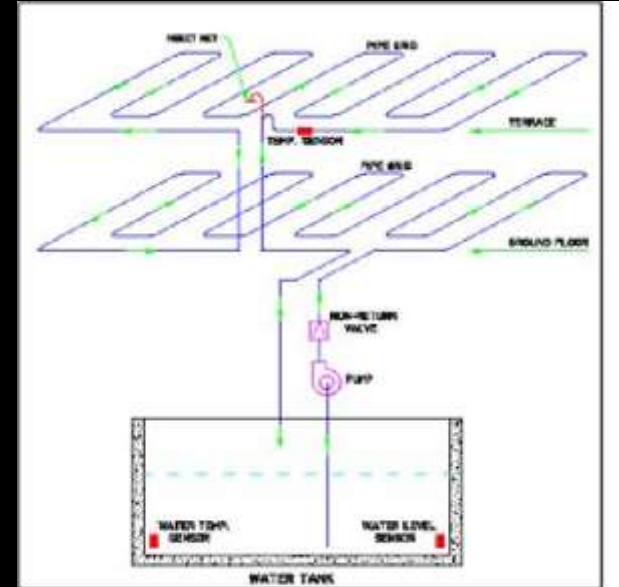
- Minimize Hard Areas
- Grass Pavers
- Hard paving with open joints and permeable sub-base
- Native plant species
- Low water consuming turf



Thermal Comfort

Radiant Cooling

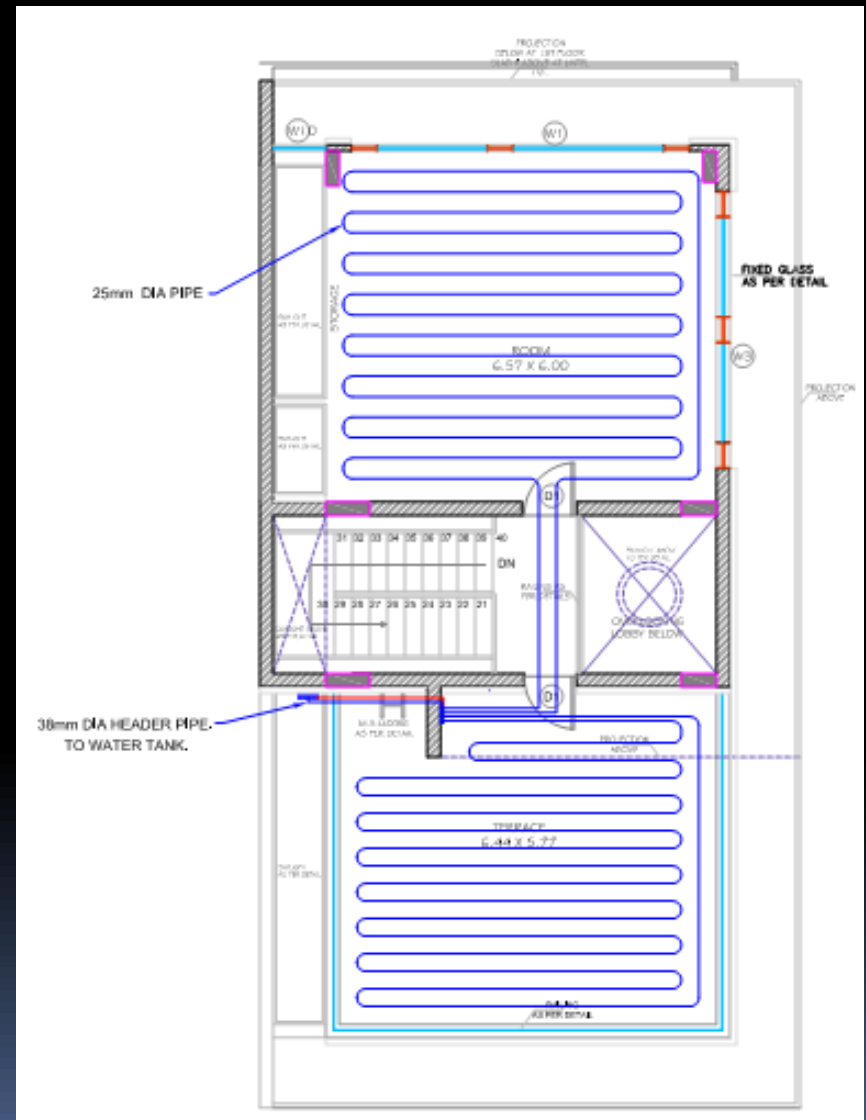
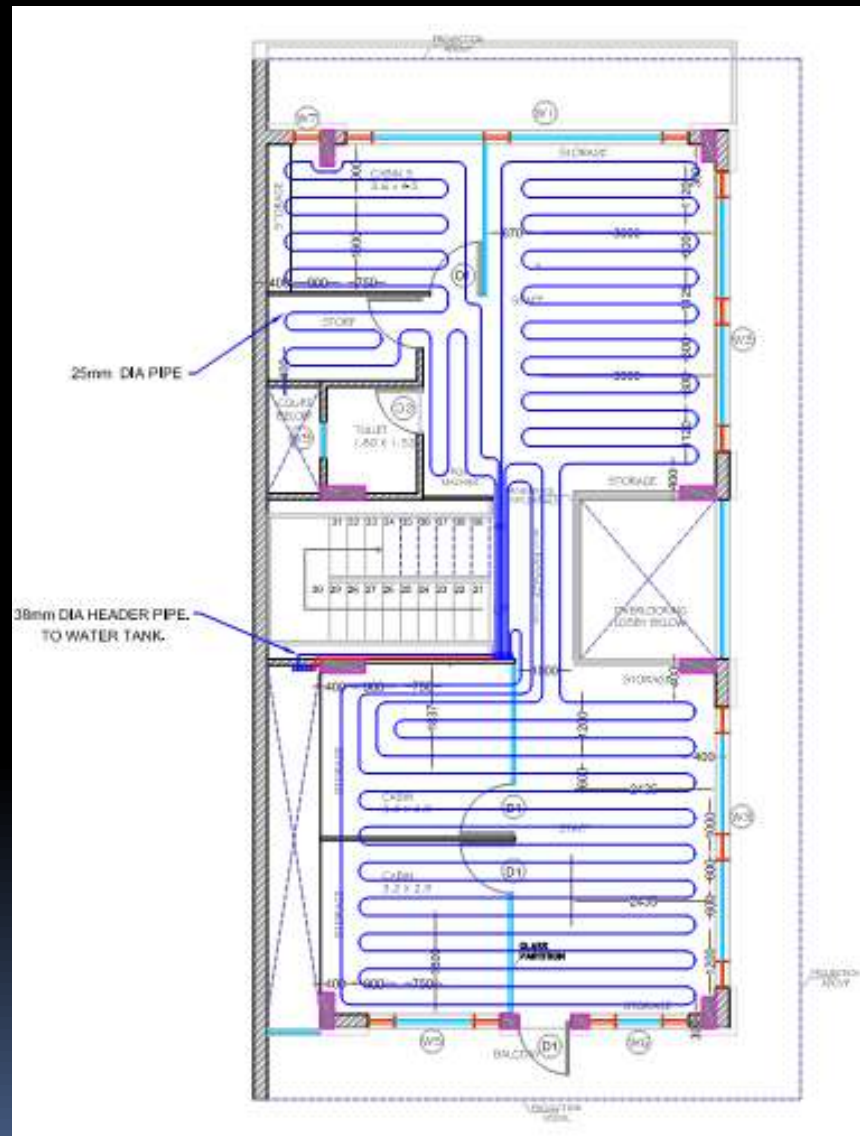
- Cold water pipes have been embedded in the flooring screed
- The cold water is circulated in a close loop system
- Thereby radiating the coolness in the building interiors
- The cold water is supplied from an underground water tank that is used as a Thermal Storage
- Only during the summers a condenser unit is used to further cool the water
- **21% energy savings**



Schematic Dig. Of Structural cooling

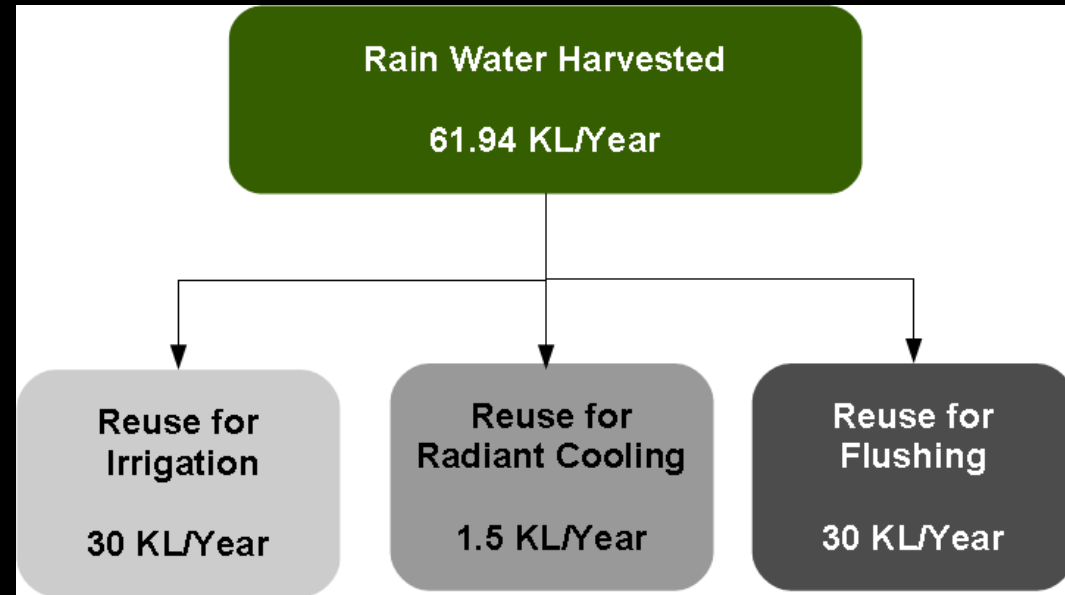


Radiant Cooling

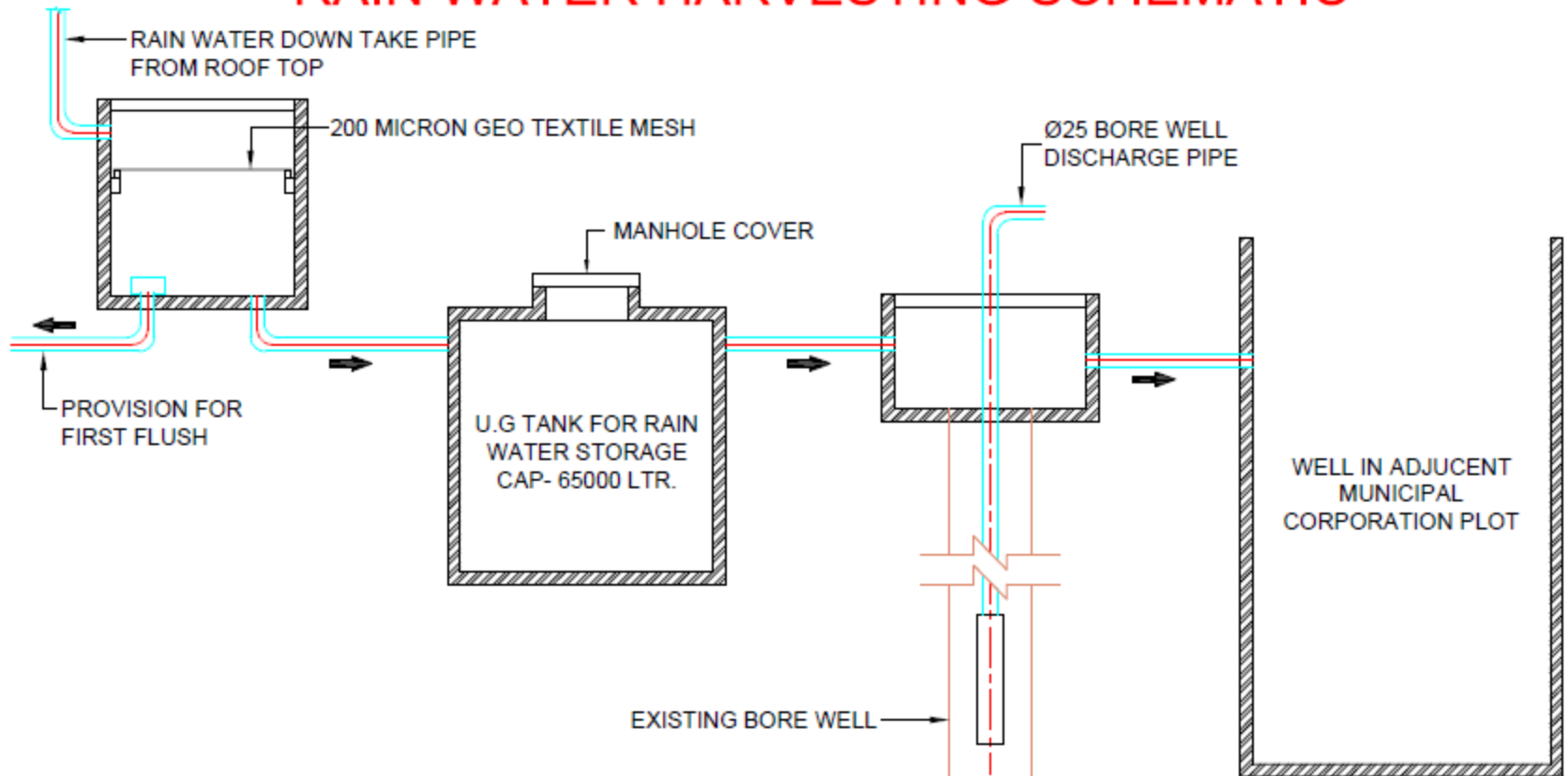


Water Management - RWH

- 100% of the Rain water is harvested
- The basement of the previously existing building was converted into a rain water harvesting tank.
- 60 KL of water is gathered per year and used for Irrigation, Flushing and Radiant Cooling Requirements.
- Around 40% of Freshwater is annually saved
- The project uses dual flushing , drip and sprinkler irrigation system, which saves water.



RAIN WATER HARVESTING SCHEMATIC



NOTES

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2. STRUCTURAL MEMBERS SHOULD NOT BE DAMAGED.
3. THIS DRAWING IS THE PROPERTY OF MILIND SERVICES AND IS NOT TO BE REPRODUCED, COPIED, HANDED OVER TO A THIRD PARTY OR USED FOR ANY PURPOSE OTHER THAN THE ONE FOR WHICH IT IS ISSUED.
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ARCHITECT/CONSULTANT
ENVIRON PLANNERS

CLIENT
MR. KIRAN CHAVAN

PROJECT
OFFICE BUILDING

DRAWING
R.W.H SCHEMATIC

MILIND SERVICES

PIPING AND SANITARY ENGRG. CONSULTANT
407, GHANSHYAM LANE, RAYWADA PETH, NASHIK - 422 001.
TEL: 2677860 / 2677862

DRAWN	E.S.V	DATE	02.07.12	DWG. NO.	REV.
CHECKED	M.A.S	SCALE	N.T.S.		

Renewable Energy Installation

- 1 KW installed capacity of Solar Panels
- Generating around 5.0 KWh/day
- Used for Lighting Requirements
- Approximately Rs. 2.5 lacs CAPEX



Building Finishes

- Use of Salvaged Wood, recovered wood for Doors and windows, chairs, sofa - Zero use of Aluminium
- No Vitrified tiles – Natural Granite Stone with low polish
- Low VOC paints were used for painting the building

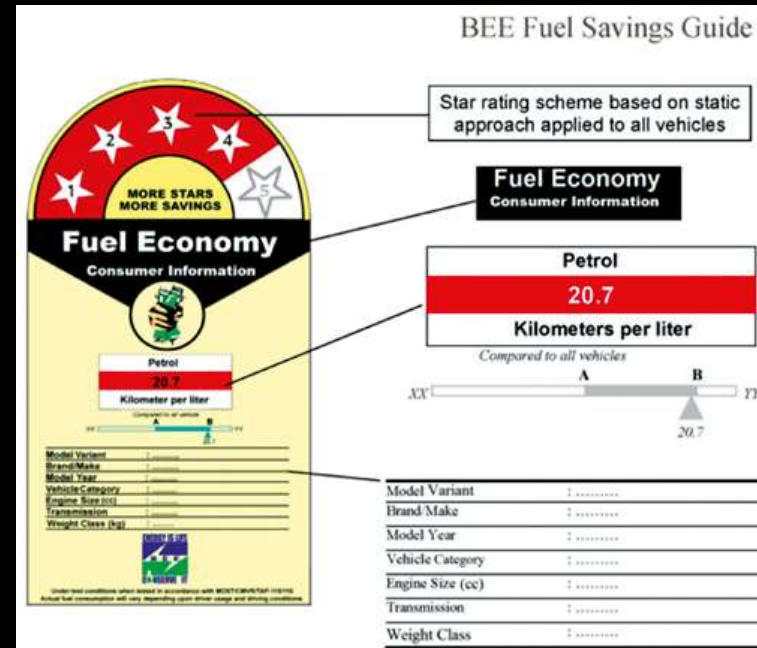


LOW ENERGY
LOW VOC



Artificial Lighting and Appliances

- LED lighting - high efficacy
- 5.31 W/sqm Lighting Power Density
- BEE 5 Star rated fans and pumps
- BEE 4 star equivalent Cassette AC – provided only in conference hall



CII Sohrabji Godrej Green Business Centre, Hyderabad

Platinum Rated

Building Size : 20,000 sq. ft.

Salient Features

- ❖ *First Green Building in India*
- ❖ *Annual Energy Savings of 1,20,000 kWh*
- ❖ *Carbon emission reduction of 100 tons/year*
- ❖ *63 % savings in energy consumption*
- ❖ *Zero water discharge building*
- ❖ *100% daylighting and views*



Turbo Energy Limited, Chennai Platinum Rated



Size : 37, 000 sq. ft.

Salient Features

❖ ***India's Greenest LEED Rated Building, II Greenest in the World***

❖ ***100% Solar air – conditioned***

❖ ***In-situ wind turbine of capacity 5kW***

❖ ***Rs. 40 Lakhs worth of old furniture was reprocessed & reused in the building***

TCS Technopark, Chennai

Gold Rated



Size : 19,22,909 sq.ft.

Salient Features

- ❖ **LEED India NC Gold Rated Building with highest built-up area**
- ❖ **100% potable water reduction for irrigation and air-conditioning make-up**
- ❖ **High COP chillers, District cooling, thermal storage & heat recovery wheels have been used**
- ❖ **95% construction waste management**

BCIL T-ZED Homes, Bangalore Platinum Rated Green Home

Size : 1,75,350 sq.ft

Salient Features

- ❖ *First Multi-dwelling units project to get IGBC Green Homes Rating*
- ❖ *Bio-gas generation catering to all the residences for cooking purposes.*
- ❖ *Zero water discharge site.*
- ❖ *Use of low embodied energy materials for construction.*



THANKYOU

