



GRIHA
and
Green Buildings in India


Apoorv Vij

Association for **D**evelopment **a**nd **R**esearch of **S**ustainable **H**abitats

26th April 2013

Why do we need buildings?



-
- We build buildings for shelter, in order to be comfortable.....
 - With respect to green buildings, comfort is analyzed from two key perspectives:
 - Visual comfort
 - Thermal Comfort
-
- 

-
- Comfort can be delivered to building occupants in through two means:
 - Natural means
 - Artificial means

Visual Comfort

Natural means



Artificial means



Thermal Comfort

Natural Means





Artificial Means



The use of electro-mechanical systems for providing “creature comforts” started around last 1800s and early 1900s.

1902 was the beginning of air-conditioning in buildings in the manner that we know today.



-
- Which means, for several centuries, rather millenia, architects had no support of electro-mechanical systems to make people comfortable in side buildings.....
 - Which means that they had to focus on “DESIGN” of the building to ensure that the people inside them were comfortable....
 - This is what we today call – Solar Passive Architecture or in more recent time – Green Design....
-
- 













Even Modernism got adapted as Tropical Modernism....with essential climatological features incorporated in each building.....










However, in the recent past, we have become too accustomed to using artificial measures to be comfortable and have in process, have given up the practice of designing according to climate... and they have become identical to every other building, from every other part of India, rather the world....







Clockwise from top: Bengal Intelligent Park Phase IV; DLF IT, Globsyn Crystals; Infinity Waterside



ROSEDALE



UNIWORLD HEIGHTS



UNITECH HORIZONS



BENGAL TOWER



DLF IT PARK



CONVENTION CENTRE



UNITECH DOWNTOWN



INFOSPACE



GLOBSYN CRYSTALS



HILLANDWOOD




SUNRISE POINT










-
- Do we want our buildings to be “Unique” in design?
 - Do we like that our buildings should “stand out” from the crowd and be recognized instantly?
-
-
- 


Guess where this building is from....





- Delhi?
- Gurgaon?
- Noida?
- Mumbai?
- Pune?
- Kolkata?
- Chennai?
- Bengaluru?
- Mohali?
- Jaipur?
- Ahmedabad?
- Nasik?
- Hyderabad?
- Cochin?
- Bhopal?
- Patna?
- Ranchi?
- Guwahati?
- Bhubaneswar?
- Jodhpur?
- Chennai?
- Mysore?

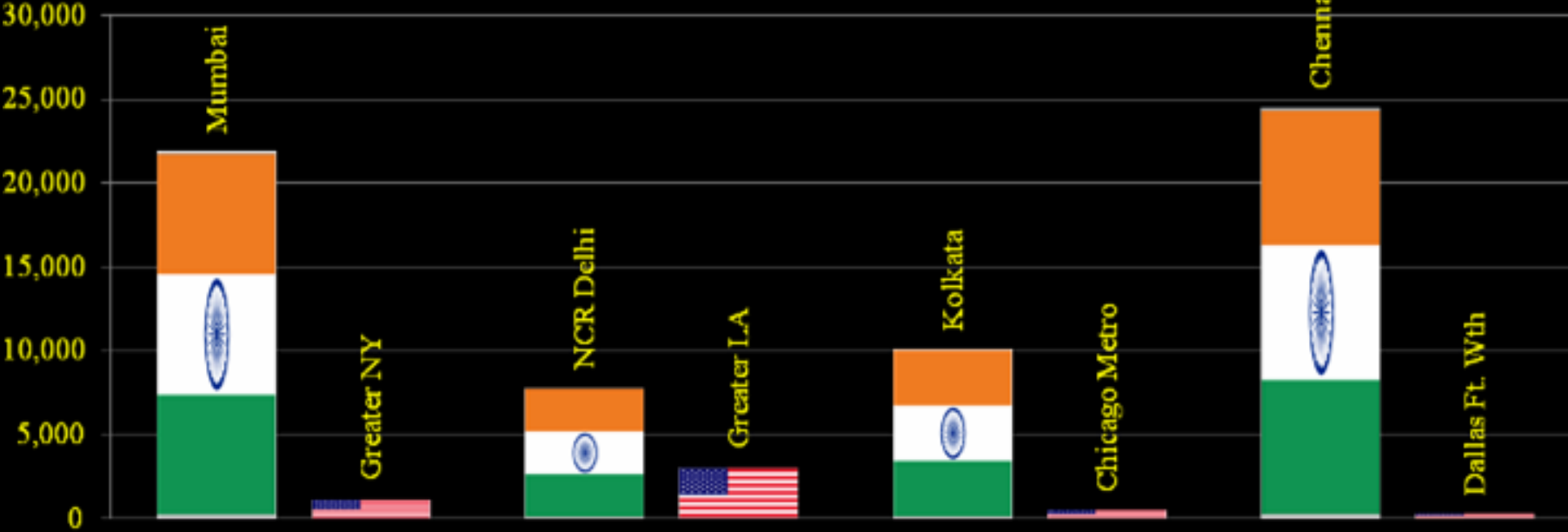
It's coming up in
JAMMU!

-
- Therefore the question goes beyond environmental issues alone.
 - Good architecture is essential for strengthening our socio-cultural identity.
-
-
- 

We can ape the WEST but should it be done???



Comparative Population Densities

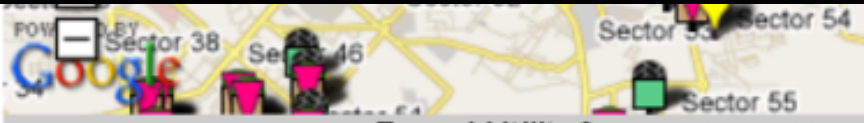


**The current development model being
adopted.....Gurgaon – The Millennium City!**





Source: http://www.skittsal.com/bilder/home03_hotel_big.jpg



Millennium City 's Power Bill To Go UP

By **ugesh sarkar**, Section **Electricity**
Posted on Tue Jun 15, 2010 at 10:01:18 PM EST

| TARIFF HIKE | |
|---|-------------------|
| Up to 40 units: | 9 paisa per unit |
| 41-300 units: | 20 paisa per unit |
| >301 units: | 27 paisa per unit |
| Bulk consumers (Hi-rise condominiums): | 21 paisa per unit |

Power bills in Gurgaon -- which already pays the highest tariffs in the country, yet faces 8-10 hours of power cuts every day -- will go up further.

A hike of 20-27 paisa per unit of electricity, effective from July, has been finalised, in the guise of 'fuel surcharge arrears'.

Haryana Electricity Regulatory Commission (HERC) has okayed the surcharge, paving the way for distribution companies to collect a whopping Rs 1,705 crore in the next 48 months from

consumers, who -- because of the power cuts -- already pay a hefty bill for back up power.

"Fuel surcharge is due to the increase in cost of power production. The government is not counting it as a power tariff hike," M.B. Vashisth, director, Dakshin Haryana Bijli Vitaran Nigam, said. "We had sought the HERC's permission to collect the same from consumers."

Source: Hindustan Times By Sanjeev K. Ahuja *Millennium City 's Power Bill To Go UP*

Win A Jeans

Win A Kurta

Menu

- submit article
- create account
- Help
- What is

Green Buildings



Green buildings

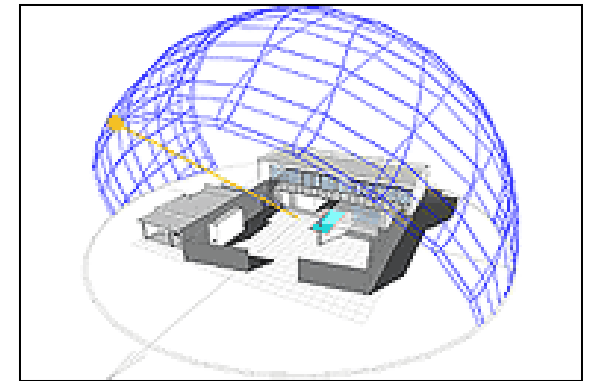
..... minimal impact on site
and surroundings



Green buildings

... energy efficiency and maximized use of renewable sources of energy

Save energy by 40-50%



Green buildings

....less water demand and recycling and reuse of water
....solid waste segregation, management and generation of resources from wastes



Save water by up to 30-40%



Green buildings

..... minimal negative impact on people
..... healthy and productive work environment




Green Design and Architecture



Solar Passive design is the most important step in green building construction.

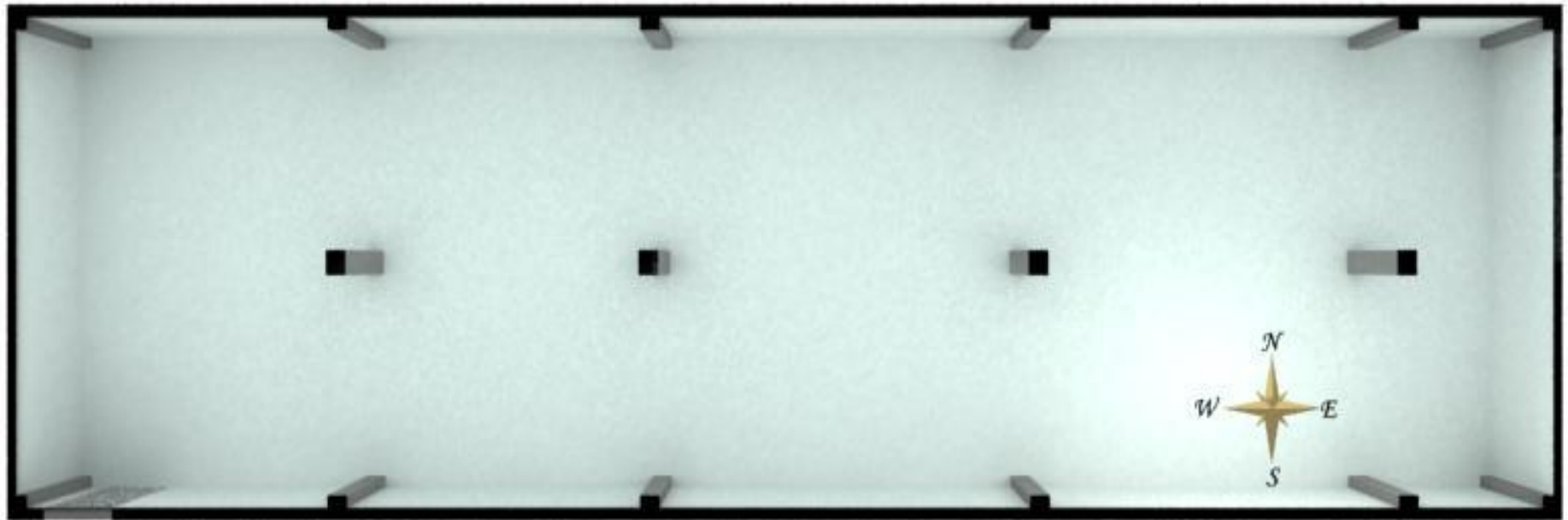
Climate-responsive design helps reduce energy and water consumption in a building without incremental cost!



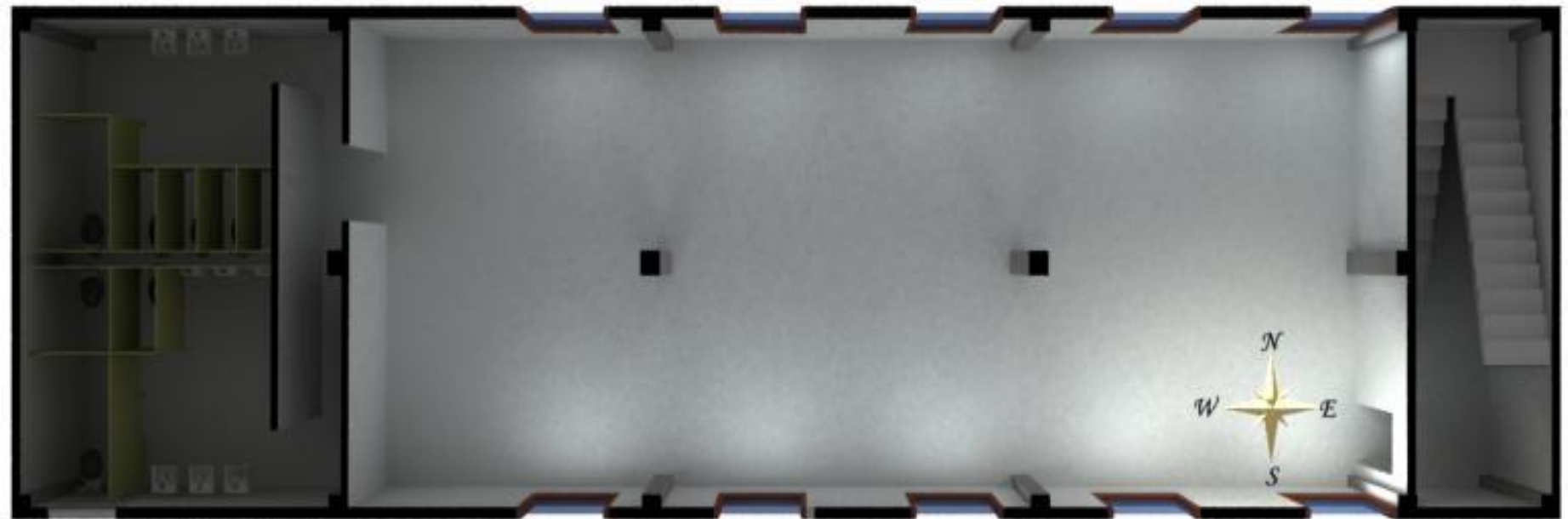
Key green design measures



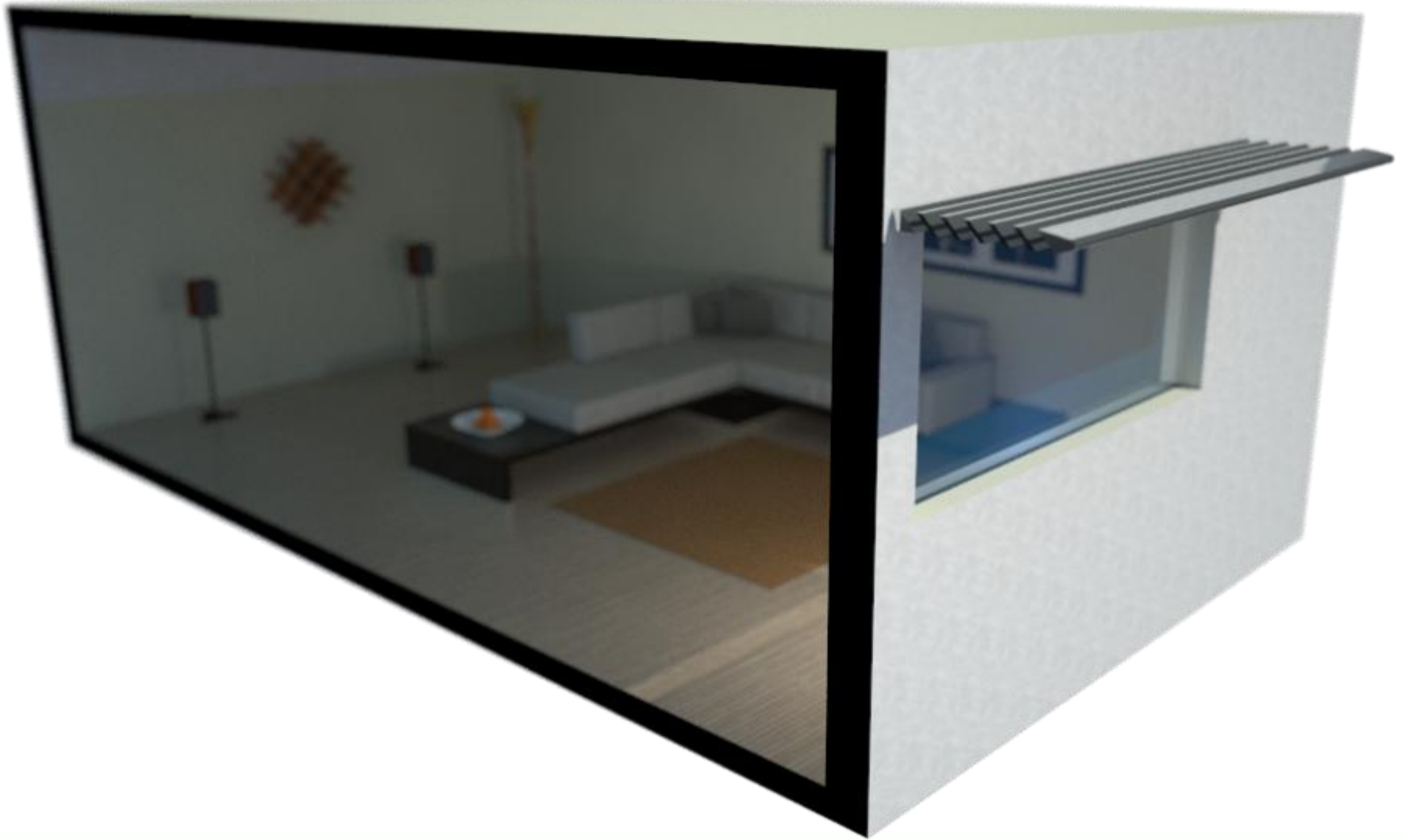
Orientation of the building



Location of service/inhabitable areas



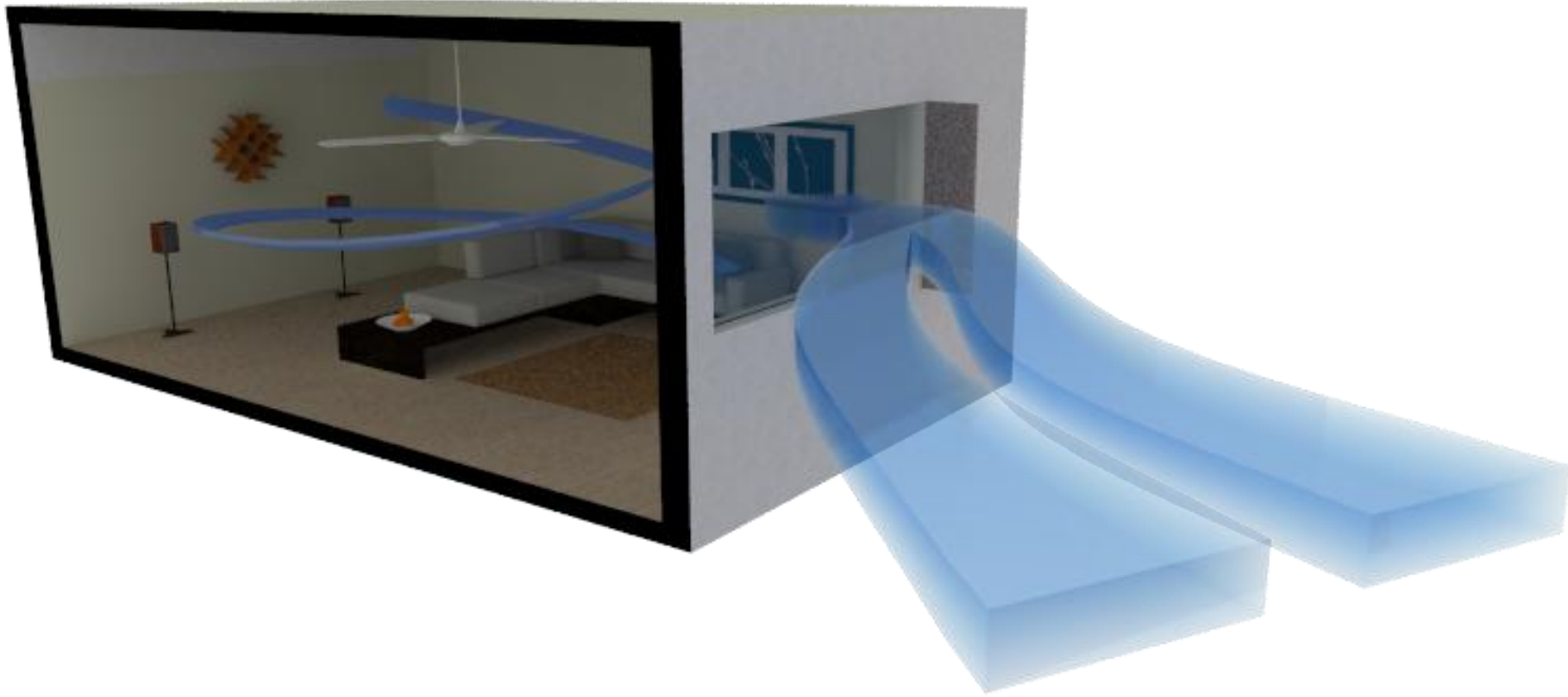
Shading of fenestrations



Shading of fenestrations



Design for natural ventilation



GRIHA



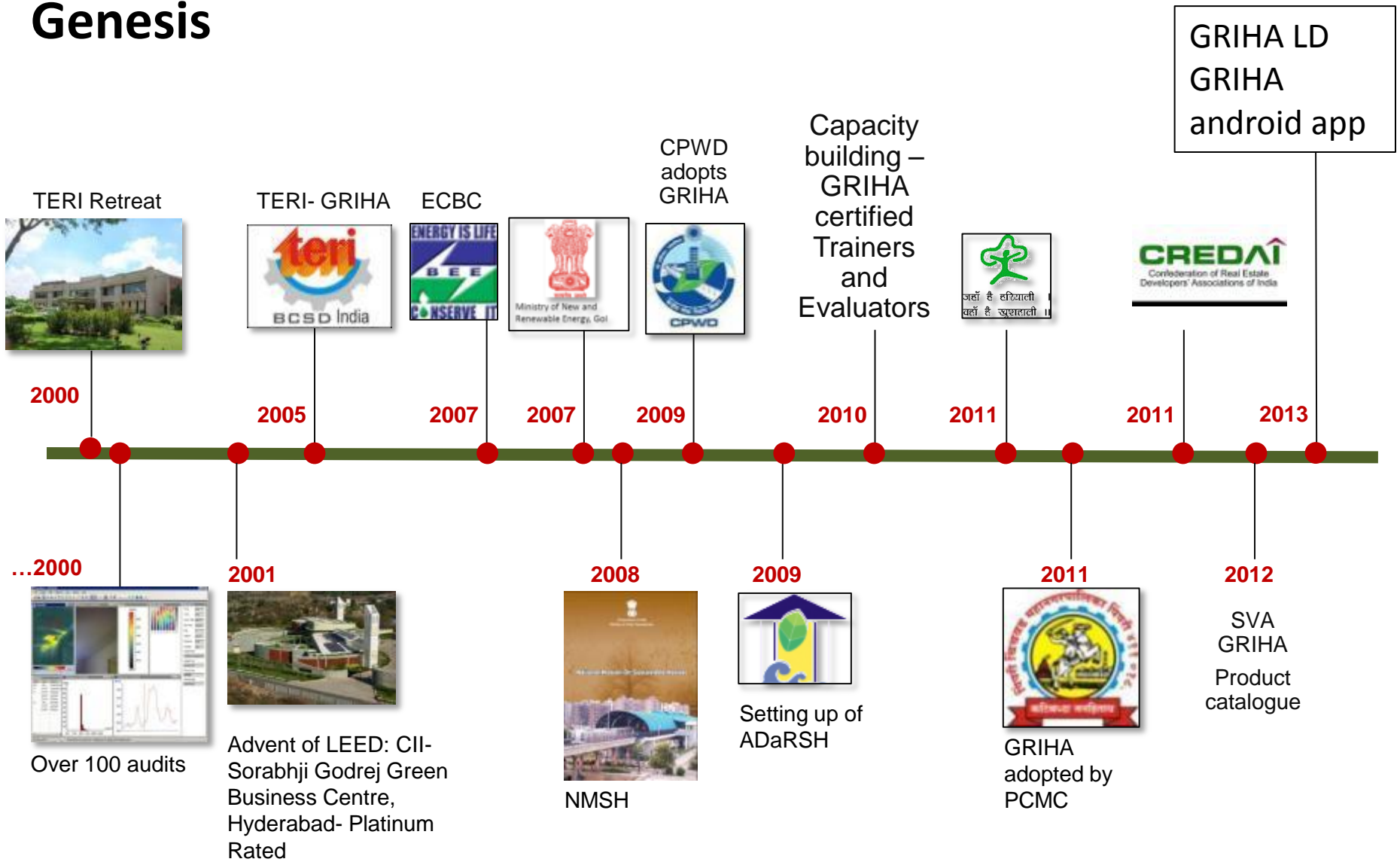
GRIHA-Green Rating for Integrated Habitat Assessment


Tool to facilitate design, construction, operation of a green building ,and in turn ...measure “greenness” of a building in India



What gets measured gets managed

Genesis



-
- Over **300** registered projects across India
 - Over **35** registered pilot projects under SVAGRIHA
 - **2** pilot projects registered under Large Development Guidelines
 - **More than 100 mn sq ft** of built-up registered under GRIHA
-
-
- 

Set of 34 criteria focusing on:

- **Site Planning**
- **Building Design**
- **Energy Efficiency**
- **Water and waste management**
- **Sustainable Building Materials**
- **Occupant Health and comfort**

100 (+4 innovation points) point system with differential weightage on various criteria

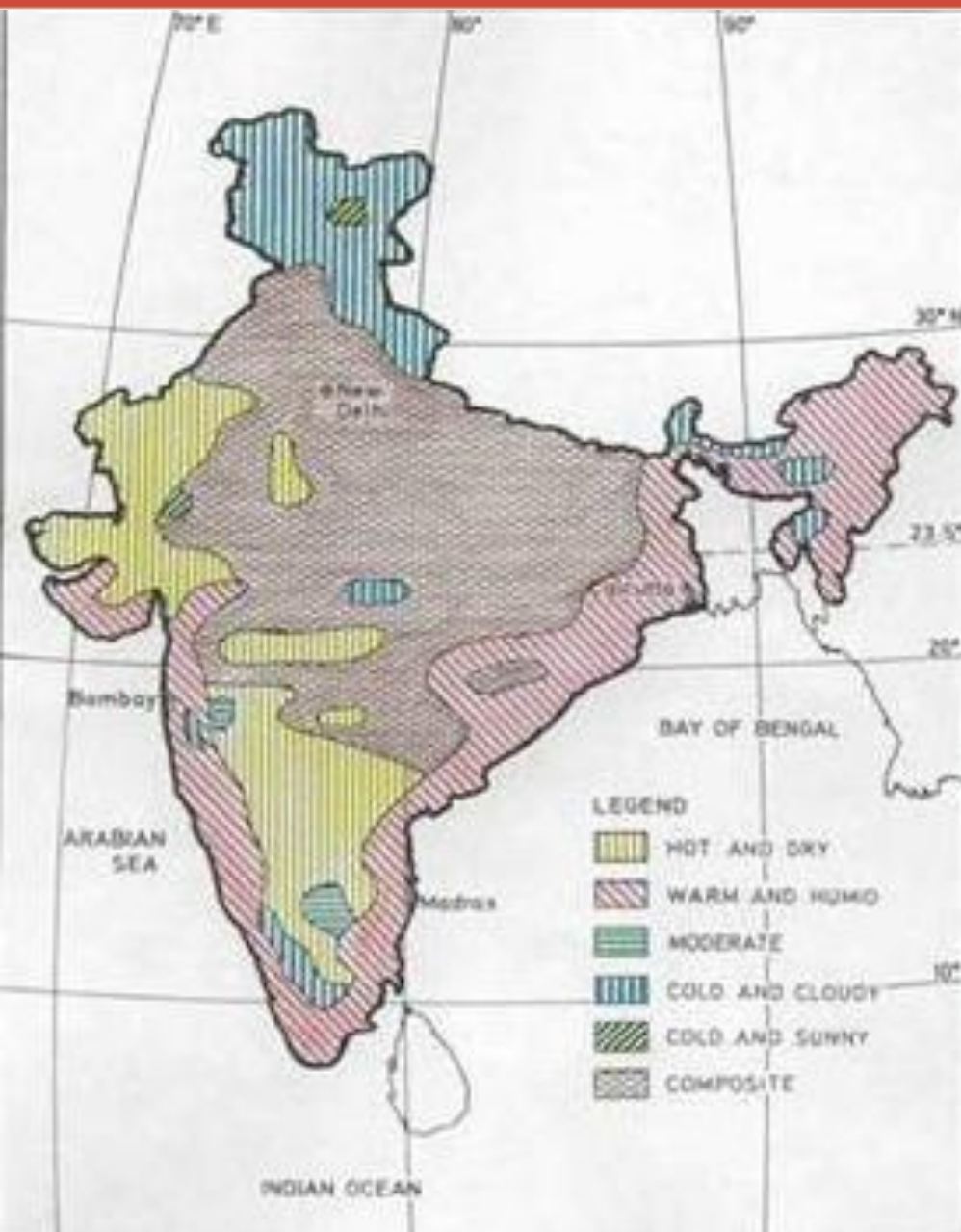


Key Features of GRIHA



Versatile rating system





- ❑ **Building types**
 - ❑ Commercial
 - ❑ Residential
 - ❑ Institutional
 - ❑ Hospitals
 - ❑ Hotels
 - ❑ Any building as long as its not a factory building
- ❑ **5 climatic zones**
 - ❑ Hot – Dry
 - ❑ Warm – Humid
 - ❑ Composite
 - ❑ Temperate
 - ❑ Cold


PTS, Tasgaon, Maharashtra – 4 star GRIHA



GYS Vision, Manesar



**Lays emphasis on “cost-effective” strategies
for making green buildings - through
INTEGRATED DESIGN APPROACH &
Good Architectural Design**



For conserving energy – in a cost-effective manner

Cheapest Solution

Most Expensive Solution

Passive
design of
building

Use of
Efficient
Systems

Use of
Renewable
Energy

PCNTDA Headquarters, Pimpri-Chinchwad



HAREDA, Panchkula





Performance based rating system

Emphasizes on Human Comfort











HAREDA, Panchkula



CESE building, IIT Kanpur



Suzlon OneEarth, Pune



INFOSYS, Hyderabad



HAREDA, Panchkula



**Evaluates energy efficiency benchmarks developed
based on actual energy audits....**



Energy Performance Indices

| Climate Classification | Daytime occupancy EPI (kWh/m ² /annum) 5 days a week | 24-hour occupancy EPI (kWh/m ² /annum) 7 days a week |
|--------------------------------------|---|---|
| Moderate | 120 | 350 |
| Composite/Warm & Humid/Hot & Dry | 140 | 450 |
| EPI for Residential Buildings | | |
| Residential Buildings | 200 (kWh/m²/annum) | |

Non-applicability clauses





Focuses on site implementation



Conditions on site before GRIHA









Conditions on site *after* GRIHA









GRIHA - Case Study - 1

TERI-GRIHA – 5 star

Centre for Environmental Science and Engineering building

IIT Kanpur















GRIHA - Case Study - 2

GRIHA – 5 star

SDB – 1

INFOSYS Hyderabad





WAY TO
THE GREENEST CITY
KUALA LUMPUR

EDUCATION
&
RESEARCH

Gayatri Himthani
Infosys Labs




SVAGRIHA

Simple

Versatile

Affordable



-
- Dedicated **design-cum-rating** tool designed for buildings with built-up area less than 2500 sqm.
 - **14** criteria covering categories: landscape, energy, water & waste, materials and lifestyle
-
- 

| Criterion number | Criterion name | Points |
|------------------|--|--------|
| 1 | Reduce exposed, hard paved surface on site and maintain native vegetation cover on site | 6 |
| 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 | 4 |
| 12 | Use of low-energy materials in interiors | 4 |
| 13 | Adoption of green Lifestyle | 4 |
| 14 | Innovation | 2 |
| Total | | 50 |

| Sub-Group | Maximum points | Minimum points to be achieved |
|-----------------------|----------------|-------------------------------|
| Landscape | 6 | 3 |
| Architecture & Energy | 21 | 11 |
| Water & waste | 11 | 6 |
| Materials | 8 | 4 |
| Others | 4 | 1 |

| Points achieved | SVAGRIHA Rating |
|-----------------|---|
| 25-30 |  |
| 31-35 |  |
| 36-40 |  |
| 41-45 |  |
| 45-50 |  |

Advantages

- A simplified system which assists architects in designing as well as rating the building



Composite

Solar Chimney/Wind Tower

Courtyards

Water bodies for evaporation

Reduced solar access

Building/Site planning to increase cross ventilation (layout of windows in the rooms and building for wind flow)

Earth berming

Thermal mass to reduce heat gain/loss

Dense vegetation cover to moderate micro-climate

Cavity walls

Terrace Garden/Green Roof

Roof insulation using clay pots(mutkas)

Design according to site slopes

Light shelves

Internal distribution of spaces to be carried out such that buffer spaces like store rooms, staircases, toilets etc. are located on the eastern and western facades

Cool roofs in the form of terrace gardens/roof ponds etc. (high reflective paint finish would not be accepted here)

Geothermal cooling/heating

Ventilators

Advantages

- A versatile system: no specific criteria is mandatory, only points in each category are

| Sub-Group | Maximum points | Minimum points to be achieved |
|--------------------------|-----------------------|--------------------------------------|
| Landscape | 6 | 3 |
| Energy | 21 | 11 |
| Water & waste | 11 | 6 |
| Materials | 8 | 4 |
| Others | 4 | 1 |

Advantages

- Design of a flowchart based on a division of a field that incorporates regional variations



>> Rainwater Harvesting <<

Points Attempted Maximum Points

Calculate

3

4

1. *Rainwater Capturing*

| | | | |
|--|---|-----------------------------|--------------------------------------|
| Location | <input type="text" value="Bhopal"/> | Average Daily Rainfall (mm) | <input type="text" value="21.9"/> |
| Building Type | <input type="text" value="Commercial"/> | | |
| Total population size | | | |
| Total building water requirement over 2 days (litre) | | | |
| Surface Finish | | | |
| Conventional Roof | <input type="text" value="20"/> | Effective Rainfall (mm) | <input type="text" value="416.1"/> |
| Roof Garden (200-500 mm thick) | <input type="text" value="2"/> | | <input type="text" value="8.76"/> |
| Concrete / Kota paving | <input type="text" value="1"/> | | <input type="text" value="20.805"/> |
| Gravel | <input type="text" value="2"/> | | <input type="text" value="32.85"/> |
| Brick Paving | <input type="text" value="10"/> | | <input type="text" value="186.15"/> |
| Total water collected from roof in 2 days (litre) | | | <input type="text" value="664.665"/> |
| Size of the rainwater harvesting tank (litre) | <input type="text" value="550"/> | | |

- Bhopal
- Commercial
- Residences
- Commercial**
- Hostels
- Hotels (upto 4 stars)
- Hospitals (beds less than 100)
- Restaurants

SVAGRIHA - Case Study - 1

SVAGRIHA – 5 star

ZED Earth Villa

BCIL

Bengaluru













SVAGRIHA - Case Study - 2

SVAGRIHA – 4 star

5 Masters' Houses, near Foothouse

Doon School

Dehradun

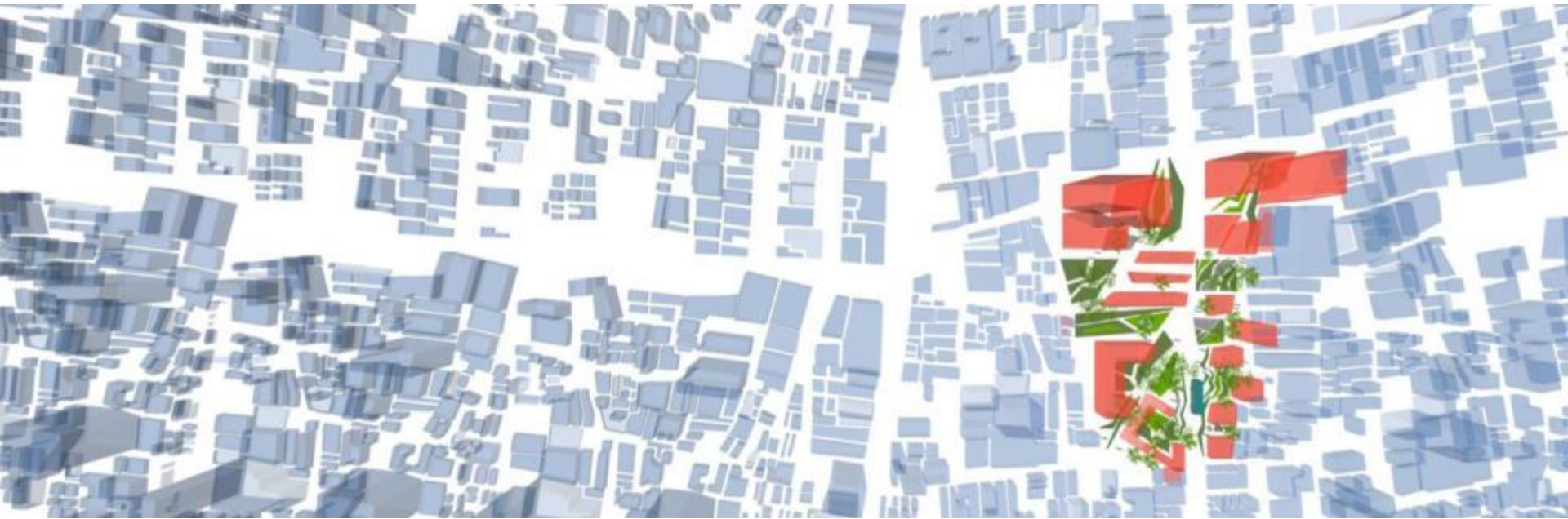








GRIHA for Large Developments



Different in Approach

Green habitats are those which reduce their detrimental impact on the environment




Conventional Rating System

The **higher** the points,
the **higher** the rating

GRIHA LD

The **lower** the
detrimental impact,
the **higher** the rating



| Overall Impact - I_t | Rating |
|--|---------------|
| 75 % - 66 % | 1 star |
| 65 % - 56 % | 2 star |
| 55 % - 46 % | 3 star |
| 45 % - 36 % | 4 star |
| 35 % or lower | 5 star |

Sections

- The Impact of the development is analysed across 6 sections, which are:
 - Site Planning
 - Energy
 - Water & Waste Water
 - Solid Waste Management
 - Transport
 - Social

Impact in each section

The impact in each section is evaluated in two parts:

- Quantitative parameters – how much?
- Qualitative parameters – how good/bad?



Carrying Capacity only indicative

Water availability to support the population
9 sqm green cover per capita
Per capita CO₂ emissions to be less than 1.18
tonnes per annum (India's national average)



Impact Parameter - Example

Water & Waste water

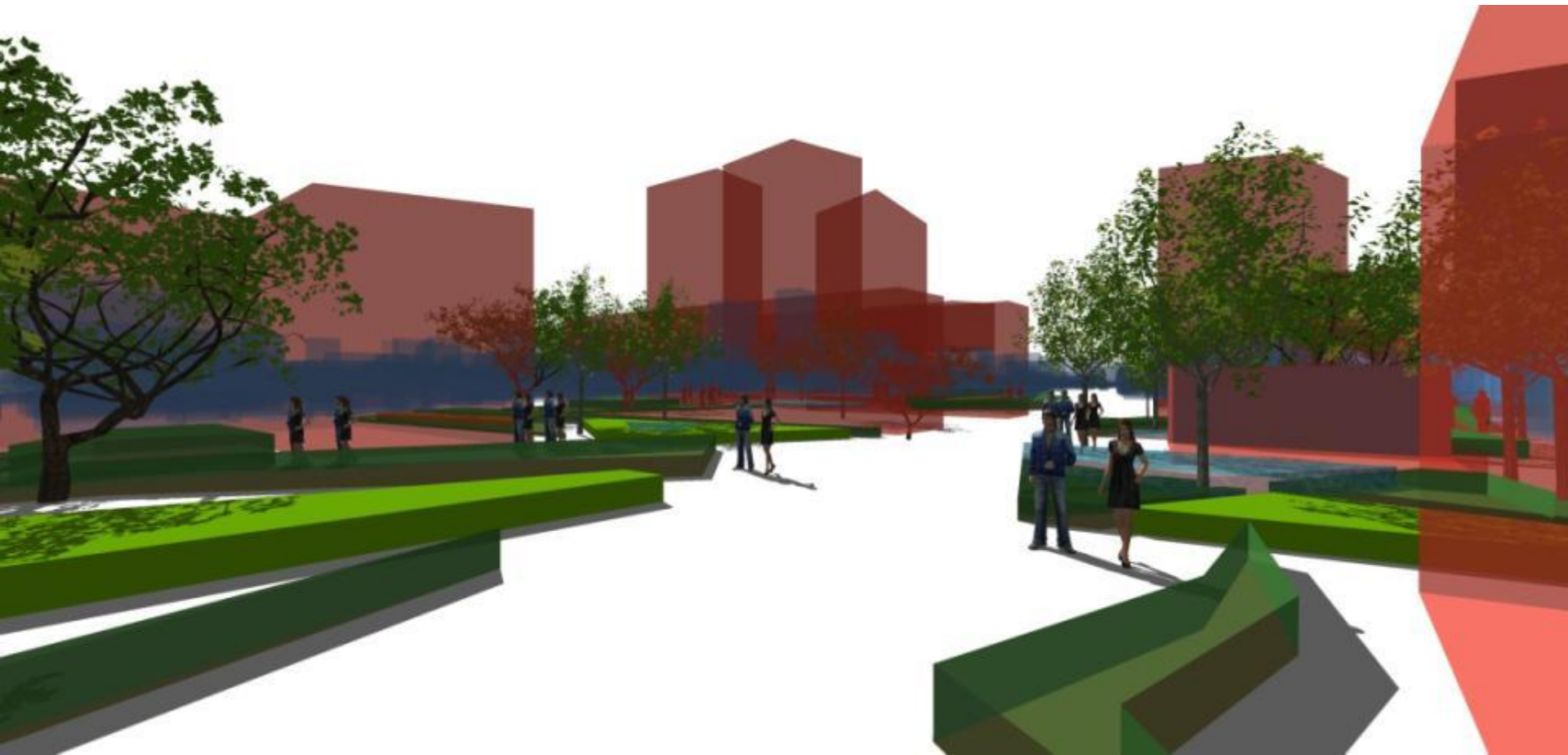
Total annual water required from the municipal supply/groundwater source

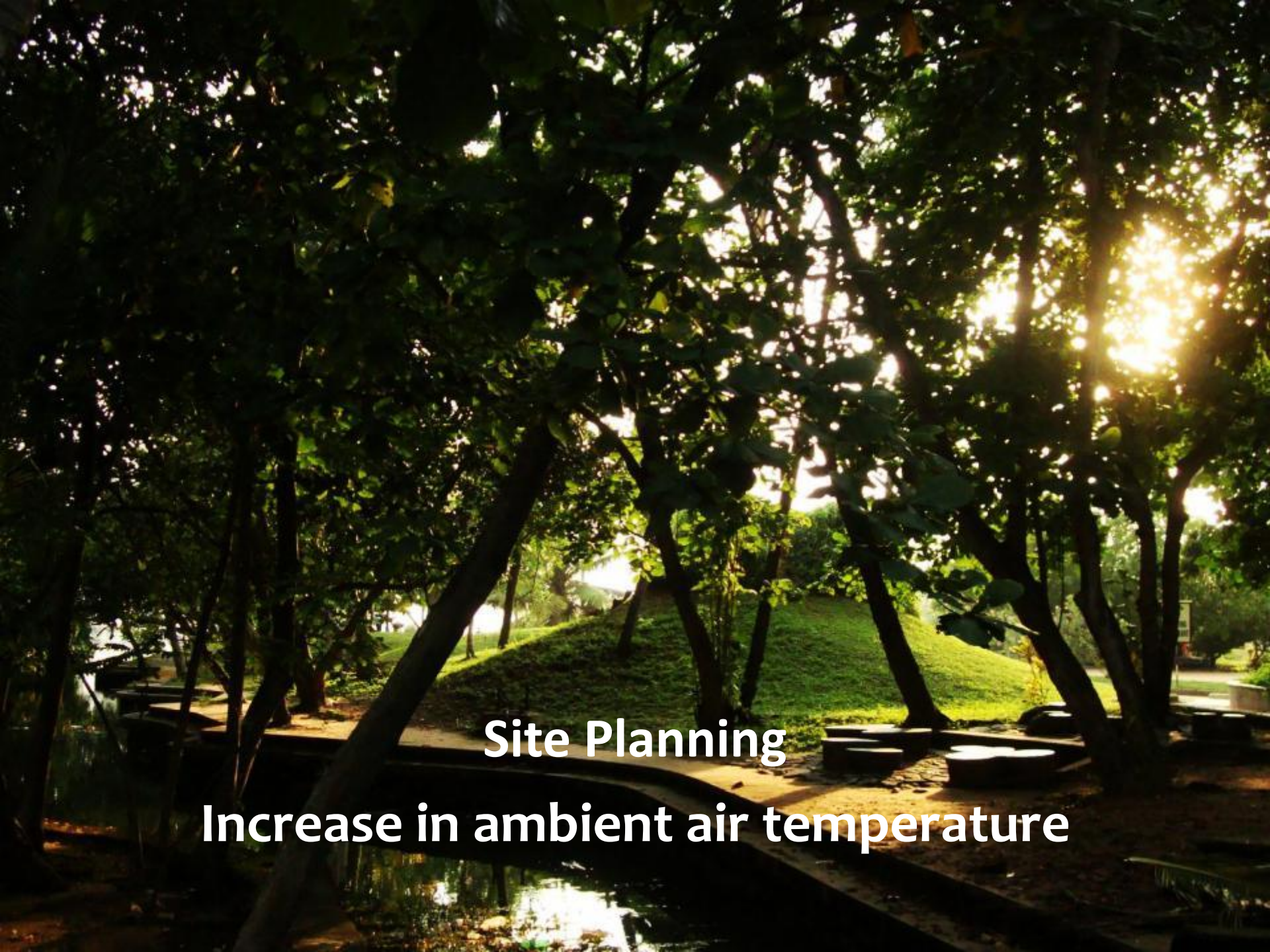
Water demand – (D)

Water Reuse – (S)

- Total water required by buildings on site – NBC – Ipcd
 - Rainwater that is captured, stored and reused after filtration
- Total water required for landscape on site
- Total water required by various utilities
 - Waste water that is recycled and reused

if \$D = \$, impact is 100%





Site Planning

Increase in ambient air temperature



Energy

**Net annual kWh required from the utility
grid/diesel genset**

Solid Waste Management

Total organic waste treated on site



Transport

Net CO₂ emitted through intra-site travel



Social



Only qualitative

Thank You

www.grihaindia.org

info@grihaindia.org

apoorv.vij@grihaindia.org

