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**WELCOME TO PRESENTATION  
ON  
GREEN BUILDING CONCEPT  
A SNAP SHOT**

**BY  
Dr. HEMANT SAHASRABUDDHE**

# WHAT IS GREEN BUILDING

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- ❑ **Green building** is the practice of creating structures and using processes that are environmentally responsible and resource-efficient throughout a **building's** life-cycle from design, construction, operation, maintenance, renovation and deconstruction.
- ❑ It conserves natural scarce resources.
- ❑ “**GREEN**” building design and construction is a method of wisely using resources to create high-quality, healthier and more energy-efficient homes and commercial buildings.

# INTRODUCTION OF GREEN-IGBC

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- ❑ It addresses national priorities includes Site Efficiency, Water Efficiency, Energy Efficiency, Material Efficiency, Handling of Consumer Waste, Usage of Local & Re-Cycled Material, Air Efficiency etc.
- ❑ It evaluates certain credit points by using a prescriptive approach and performance based approach.
- ❑ Intangible benefits of Green Home include enhanced air quality, excellent day lighting, Health & wellbeing of occupants, safety benefit, conservation of scarce national resources.

# INTRODUCTION OF GREEN-IGBC

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- ❑ Indian Green Building Council (IGBC) launched Green Home Rating System formed in 2001.

(Origin US LEED rating Council-1993) (Nation wise Independent Councils)

- Established at Hyderabad.
- Provides various rating programme for Single building, Group of buildings, use of building etc.
- Introduced various technological aspects for green concept.
- Introduced various innovative material to be used in Green.
- Rating programme which always subjected to revision periodically with amendments.

# PROJECT REGISTRATION AND CERTIFICATION WITH IGBC

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- ❑ To register a project with IGBC.
- ❑ To submit a proposal before IGBC for Preliminary Certification giving details of all parameters along with proposed LEED credit points.
- ❑ After scrutiny of Proposal from IGBC, Preliminary Certification is granted by IGBC with terms and conditions to be followed during construction activities.
- ❑ Periodical review from IGBC during work progress.
- ❑ Application for final certification from IGBC after work completion submitting all relevant details, manufacturers certificate.
- ❑ To obtain final certification.

# LEED Rating System

## IGBC Check list

Total Points			77
Points			
10	Site Efficiency	Possible Points:	10
Yes	Mandatory Requirement 1	Local Regulations	
Yes	Mandatory Requirement 2	Soil Erosion	
1	Site Credit 1.0	Basic Amenities	1
2	Site Credit 2.0	Natural Topography or Landscape	2
2	Site Credit 3.0	Heat Island Effect on Roof	2
2	Site Credit 4.0	Parking Facilities	2
1	Site Credit 5.0	Non Fossil Fueling Facility for Vehicles	1
1	Site Credit 6.0	Design for Physically Challenged	1
1	Site Credit 7.0	Home User Guide	1
23	Water Efficiency	Possible Points:	23
Yes	Mandatory Requirement 1	Rainwater Harvesting, 30%	
Yes	Mandatory Requirement 2	Water Efficient Fixtures	
2	Water Credit 1.0	Turf Design	2
3	Water Credit 2.0	Drought Tolerant Species	3
2	Water Credit 3.0	Management of Irrigation System	2
3	Water Credit 4.0	Rainwater Harvesting, 50%, 70%, 90%	3
2	Water Credit 5.0	Grey Water – Treatment	2
3	Water Credit 6.0	Grey Water – Reuse	3
2	Water Credit 7.0	Plumbing Systems for Flushing	2
6	Water Credit 8.0	Water Efficient Fixtures, 10%, 20%	6

# LEED Rating System contd..

19	Energy Efficiency	Possible Points:	19
Yes	Mandatory Requirement 1	<b>CFC Free Equipment</b>	
11	Energy Credit 1.0	<b>Energy Performance</b>	11
1	Energy Credit 2.0	<b>Metering</b>	1
	Energy Credit 3.0	<b>Refrigerators</b>	0
1	Energy Credit 4.0	<b>Solar Water Heating Systems</b>	1
1	Energy Credit 5.0	<b>Captive Power Generation</b>	1
3	Energy Credit 6.0	<b>Onsite Renewable Energy</b>	3
	Energy Credit 7.1	<b>Lighting - Internal</b>	0
1	Energy Credit 7.2	<b>Lighting - External</b>	1
1	Energy Credit 8.0	<b>Energy Saving Measures in other Equipment</b>	1
12	Materials	Possible Points:	12
Yes	Mandatory Requirement 1	<b>Separation of Wastes</b>	
3	Material Credit 1.0	<b>Waste Reduction during Construction</b>	3
1	Material Credit 2.0	<b>Solid Waste Management, Post Occupancy</b>	1
2	Material Credit 3.0	<b>Materials with Recycled Content</b>	2
	Material Credit 4.0	<b>Rapidly Renewable Materials</b>	0
2	Material Credit 5.0	<b>Local Materials</b>	2
	Material Credit 6.0	<b>Reuse of Salvaged Materials</b>	2
2	Material Credit 7.0	<b>Wood Based Materials and Furniture</b>	2

# LEED Rating System contd..

9	Indoor Air Quality		Possible Points:	9
Yes	Mandatory Requirement 1	Tobacco Smoke Control		
Yes	Mandatory Requirement 2	Day Lighting, 50%		
2	IAQ Credit 1.0	Exhaust Systems		2
1	IAQ Credit 2.0	Fresh Air Ventilation		1
2	IAQ Credit 3.0	Low VOC Materials		2
	IAQ Credit 4.0	Carpets		0
1	IAQ Credit 5.0	Building Flush Out		1
2	IAQ Credit 6.0	Day Lighting, 75%, 95%		2
1	IAQ Credit 7.0	Cross Ventilation		1
4	Innovation in Design		Possible Points:	4
1	INN Credit 1.1	Innovation		1
1	INN Credit 1.2	Innovation		1
1	INN Credit 1.3	Innovation		1
1	INN Credit 2.0	IGBC AP		1

Points Attempted	Out of Total Points - 77
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Certified - 30 to 37 points
Silver - 38 to 44 points
Gold - 45 to 52 points
Platinum - 53 to 77 points

Rating	
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# GREEN HOME PROCESS

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## ▣ **PARAMETERS :**

- ▣ Site Efficiency
- ▣ Water Efficiency
- ▣ Energy Efficiency
- ▣ Material Efficiency
- ▣ Indoor Air Quality

# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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## □ **Site Efficiency :**

- Project shall be within local regulation
  - Safeguarding – DCR, Building Byelaws
  - Within frame work of National Building Code.
  - Within MRTP/SRTP provisions
- Regulation ranges depending upon quantum of Project. Exp - for larger quantum
  - Required above
  - MOEF, Forest, Archeology, Irrigation etc.
  - AAI for larger height
  - SPCB / CPCB clearances
  - Clearances from District Collector pertaining land etc.

# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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## Site Efficiency Contd...

### □ Control Soil Erosion

- Its a natural phenomenon, erosion can be reduced.
- To prevent soil erosion-various methods
- To provide shrub plantation
- To provide turf
- To construct retaining walls for preventing soil sliding.
- To conserve top soil layer for landscape purpose.



# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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## Site Efficiency contd...

To control Soil Erosion

- ❑ Planting vegetation, trees, ground cover, shrubs and other plants. Roots from these plants will help hold soil in place on the ground.
- ❑ Create windbreaks, which are barrier rows planted along the windward exposure of a plot of land. Windbreaks made out of trees, brushes.
- ❑ Grow cover crops on farm land. When land is not being used during the off season, matting can help prevent soil erosion due to wind and rain.
- ❑ Apply mulch to retain moisture and also help prevent soil erosion. Topsoil is not as likely to be washed or blown away when it is covered by mulch.
- ❑ Construct surface runoff barriers, such as edging made of bricks or stones, can help prevent soil erosion by minimizing runoff.

# GREEN HOME PROCESS- RESEARCH METHODOLOGY

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## **Site Efficiency Contd...**

- ❑ Provide Basic Amenities to the site (within 1.50 Kms)  
Commercial, School, College, Hospital, Library, markets, worship places etc.
- ❑ To maintain natural topography.  
Top soil to be conserved. Rich for cultivation.  
Conserve contouring- Planning with no tampering
- ❑ Ample Parking Facilities (DCR Provisions)
- ❑ Design for Physically Challenged.  
Uniformity in floor level, easy access.
- ❑ Provide Home User Guide to Occupants.

# GREEN HOME PROCESS- RESEARCH METHODOLOGY

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## ❑ **Water Efficiency :**

- ❑ Rain Water Harvesting to increase GWT & to reduce usage of water through effective rain water management.
- ❑ Erection of waste water treatment unit to promote usage of Gray Water / Re-Cycled Water.
- ❑ Minimize Indoor water usage by installing efficient water fixtures.

# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

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## ❑ **Water Efficiency :**

- ❑ Rain Water Harvesting to increase GWT & to reduce usage of water through **effective rain water management.**

Evaluate runoff with the help of rain fall

Surface Run Off & Roof Water

Recharge - Retention – Reuse (Most Industries use stored Water)

**Recharge-** Filtration Unit + Polypropylene Plastic liner tank + Recharging  
+ Overflow to discharge or infiltration pit

Rain water Harvesting – IGBC Standards

50% Runoff from roof area [CP1]

75% Runoff from roof area [CP2]

95% Runoff from roof area [CP3]

# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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- Minimize Indoor water usage by installing efficient water fixtures. – IGBC Standards

Flushing 6.5 LPF

Taps 7.6 LPM

Showers 7.6 LPM

- Erection of waste water treatment unit to promote usage of Gray Water / Re-Cycled Water.

FMR / MBR depending upon use.

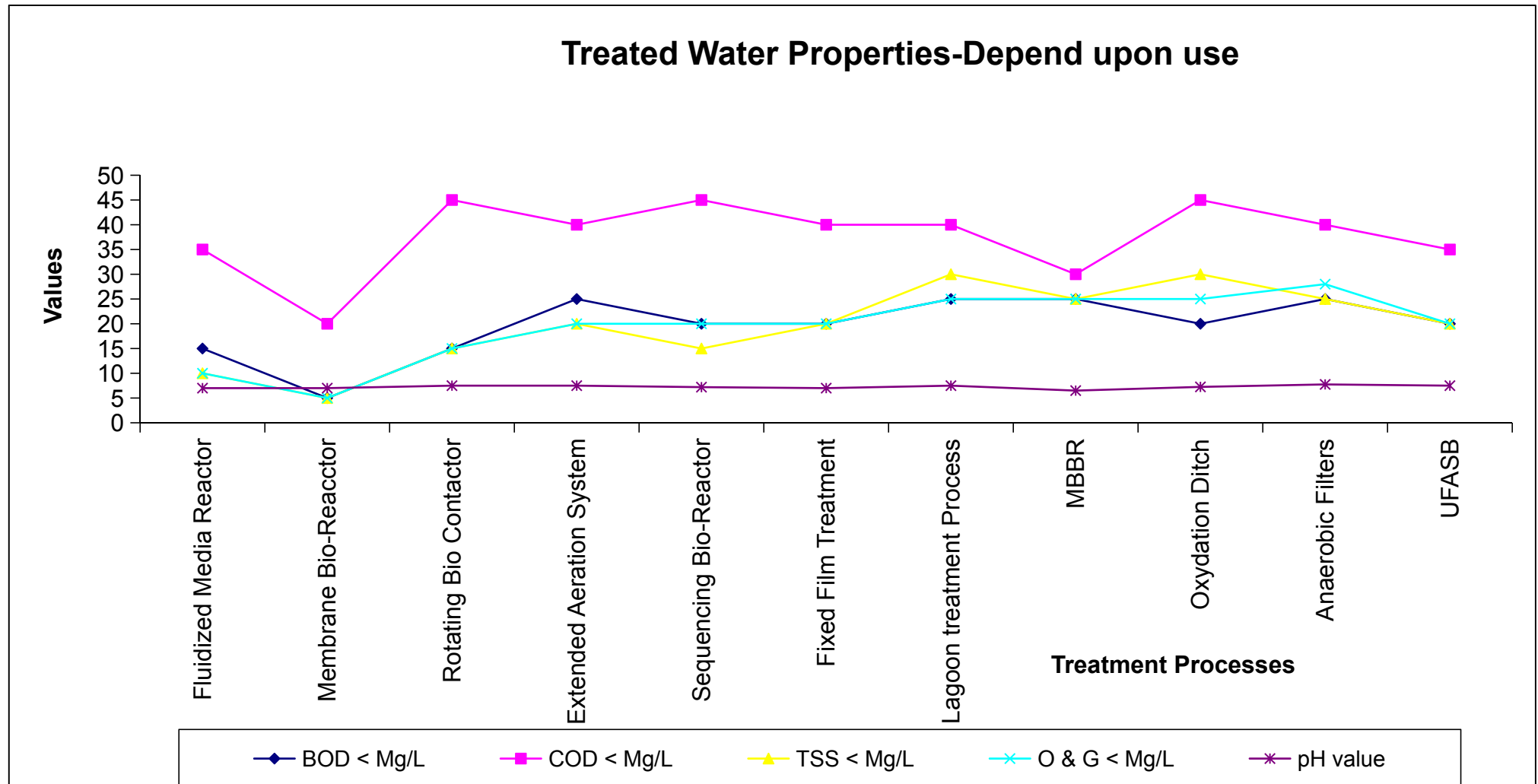
Grey Water Treatment – IGBC Standards

75% black water treated [CP1]

95% black water treated [CP2]



# GREEN HOME PROCESS-RESEARCH METHODOLOGY



# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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RAW



FMBR



MBR

# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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## Water Efficiency Contd...

- Landscape : Turf Design – IGBC standards

Turf area % as compared to landscape area <20% [CP2]

Turf area % as compared to landscape area <40% [CP1]

To evaluate total open space

To evaluate total landscape area

To propose turf area depending upon CR points

To compare turf area with total landscape area

# WATER EFFICIENCY contd...

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## □ Drought Tolerant Species – IGBC Standards

Drought tolerant species > 20% of landscape area [CP1]

Drought tolerant species > 30% of landscape area [CP2]

Drought tolerant species > 40% of landscape area [CP3]

Dalosperra



Gaillardia



Rudbeckia



# ENERGY EFFICIENCY

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## □ Energy Performance-

For India (Most of part) having Hot & Dry climate the comfortable U-Value (Thermal Resistance) prescribed as 3.3 Watt/M<sup>2</sup>Kelvin for glazing to openings.

For India (Most of part) having Hot & Dry climate the average U-Value for roof and wall is prescribed as 0.60 to 0.70 W/M<sup>2</sup>K.

U-Value for individual building prototype is evaluated and its additional costing along with pay back period, energy saving per sqm per annum need to be evaluated.

# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

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## **Energy Efficiency :**

- ▣ Use of CFC Free Equipment.
- ▣ Use of Solar System for hot water, illumination at open spaces and Street Lighting.
- ▣ For Solar Power Generation 1MW

System Solar PV (Photovoltaic) / Crystalline

Area Requirement 1Lac sqft / MW

CAPAX Rs. 6.80 Cr (Civil Works+Solar Model+Evacuation cost+others )

Total Units of Generation 1600000

Cost of Power @ Rs. 10/- per Unit = Rs. 1.60 Cr

Pay Back Period 4.25 Years.

30% subsidy from Govt. for CAPAX

# ENERGY EFFICIENCY contd...

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## □ Properties of AAC blocks

Face Size	mm	600x200				
Thickness	mm	75	100	150	200	230
Dry Weight	Kg	5.25	7.0	8.75	14.0	16.10
Compressive Strength	N/sqmm	3.0				
Normal Dry Density	Kg/CuM	550-600				
Thermal Conductivity ( U-Value)	W/SqmK	0.67				
Sound Resistance	db	37				
Fire Resistance	Hrs	4				

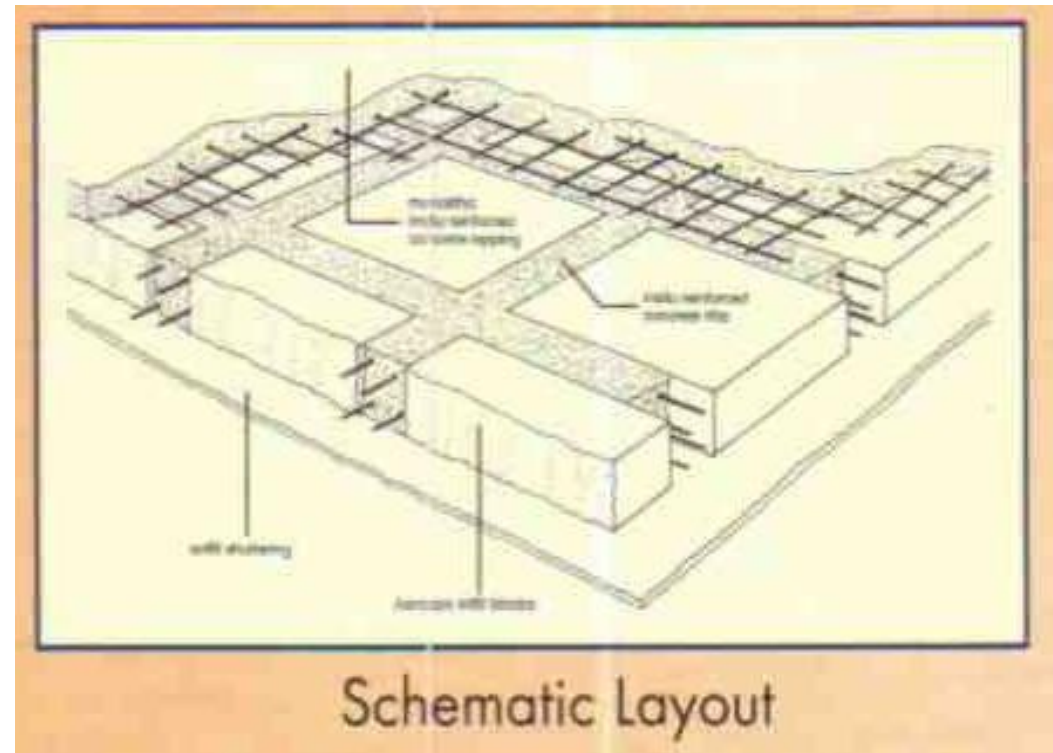


# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

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## Energy Efficiency Contd....

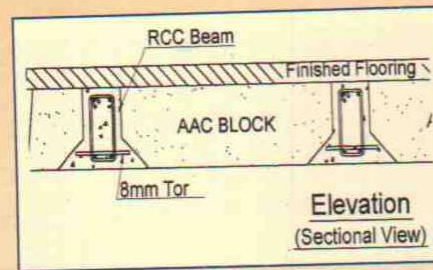
- Heat from walls 30%, from Roof 70%
- Bld. Elevation considering Sun Path Diagram.
- Use of Hollow Brick wall with fly ash material Insulated blocks,
- Cavity wall const having U-Value around 0.70.
- Solar Heat Gain Coeff. consideration.



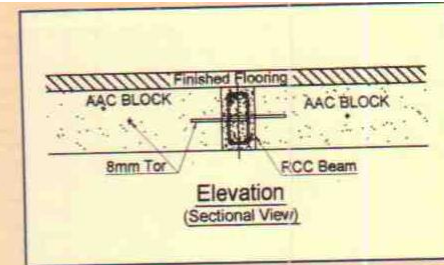


# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

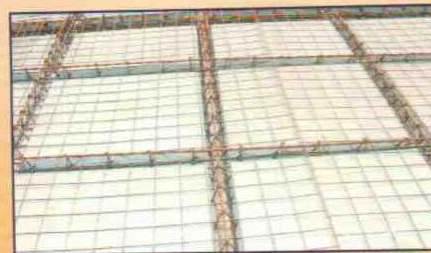
## AEROCON IN FILL BLOCK CONSTRUCTION SLAB



Schematic Taper Layout



Schematic Side Locking



Actual view Taper Locking



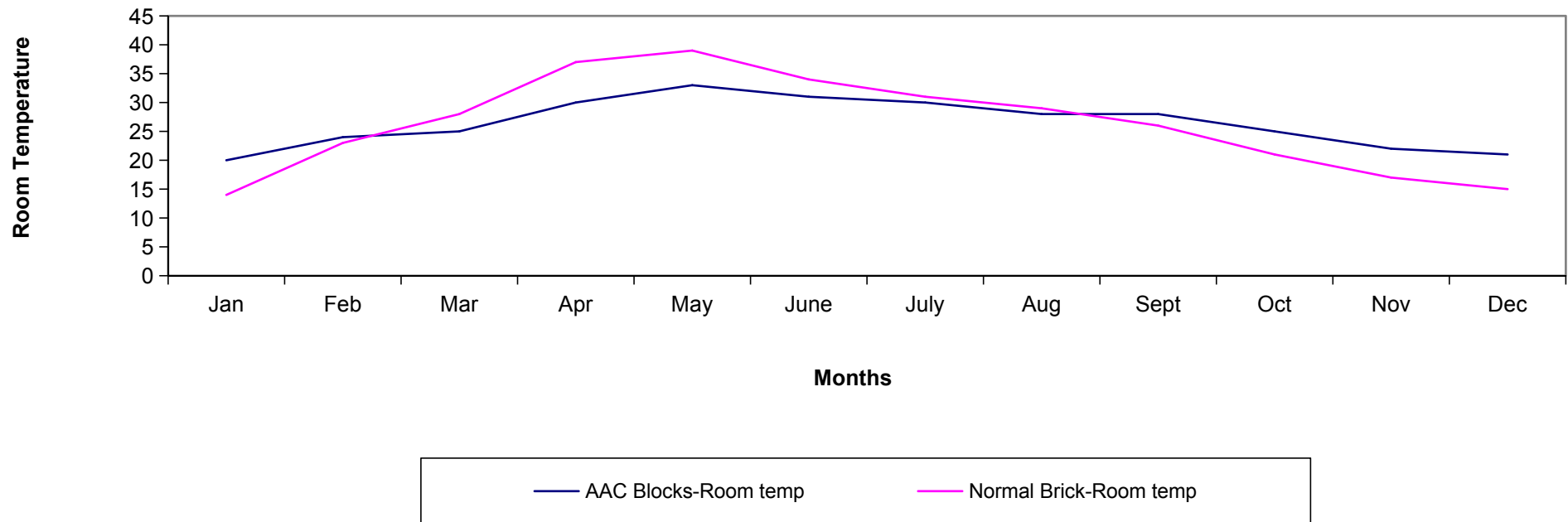
Actual view of Side Locking



# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

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Room temperature variation for AAC blocks and Normal Brick at Nagpur



# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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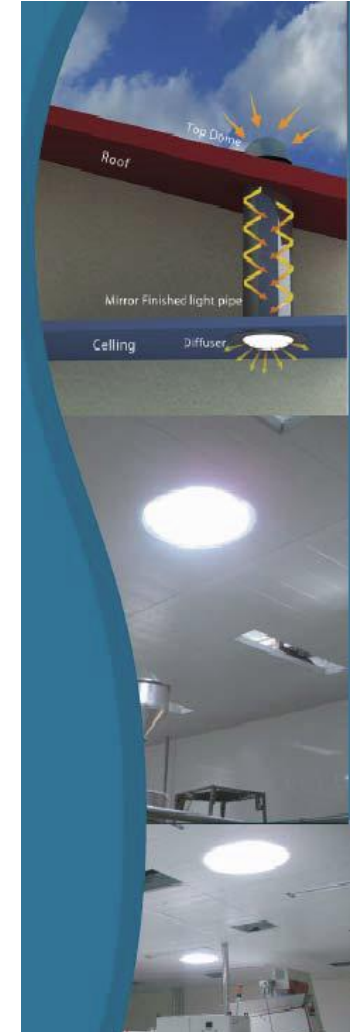
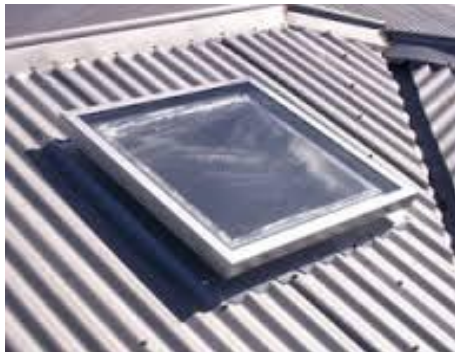
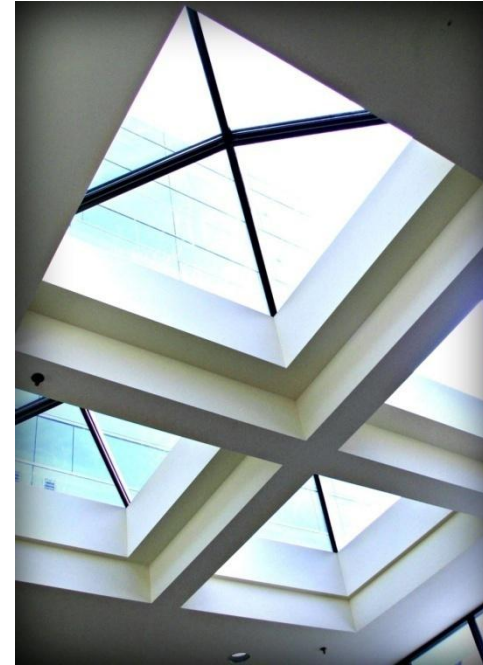
## Energy Efficiency Contd....

- ❑ High performance glass to openings / windows.
  - DG Window with optimum U-Value 2.50 to 3.50 towards south and west sides openings.
  - SG Window with optimum U-Value ranging from 4.50 to 5.50 towards North and East sides openings.
- ❑ Building Insulation - Use of an Insulating Material like "Styrofoam" to for better insulation (fixit).
- ❑ Terrace shall have surface coat which reflects sun rays, UV Rays reducing inside temperature.

# GREEN HOME PROCESS-RESEARCH

## METHODOLOGY-sky shades

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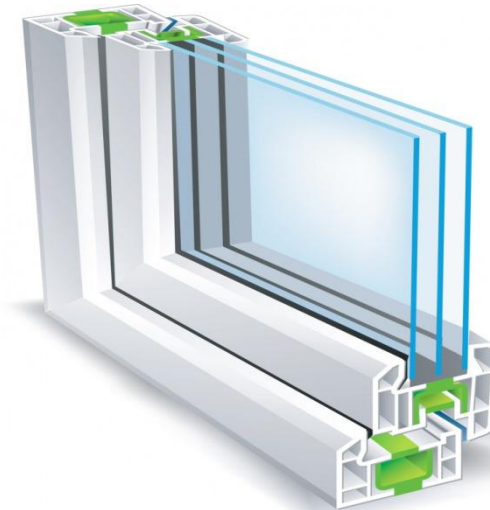
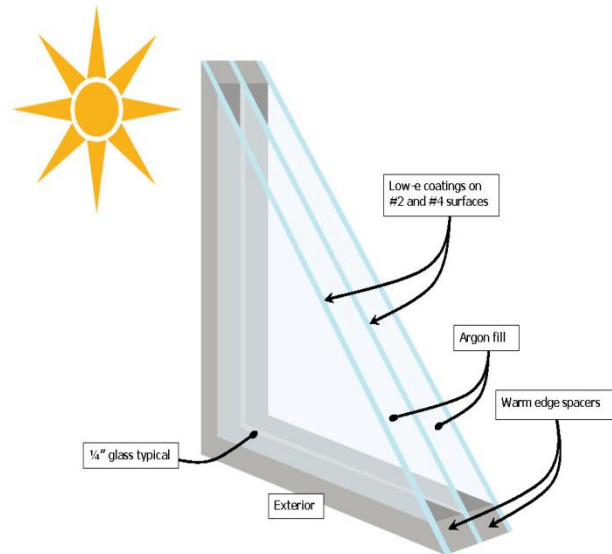
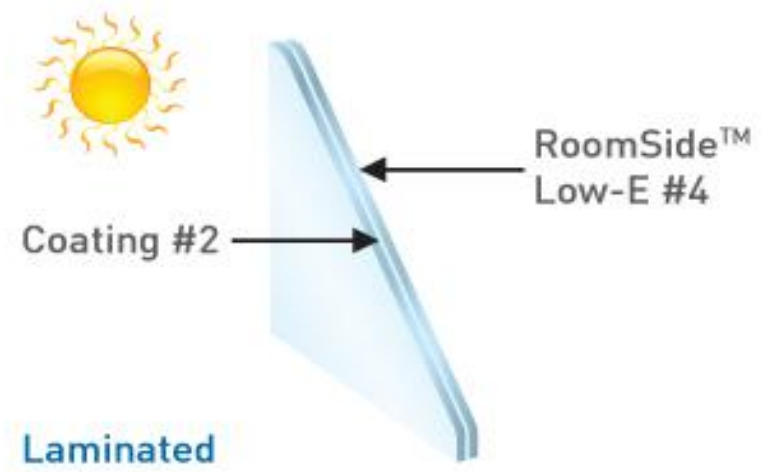
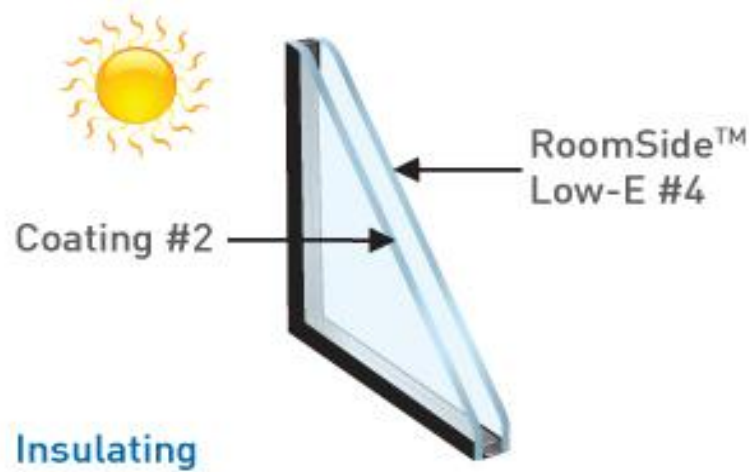




# GREEN HOME PROCESS-RESEARCH

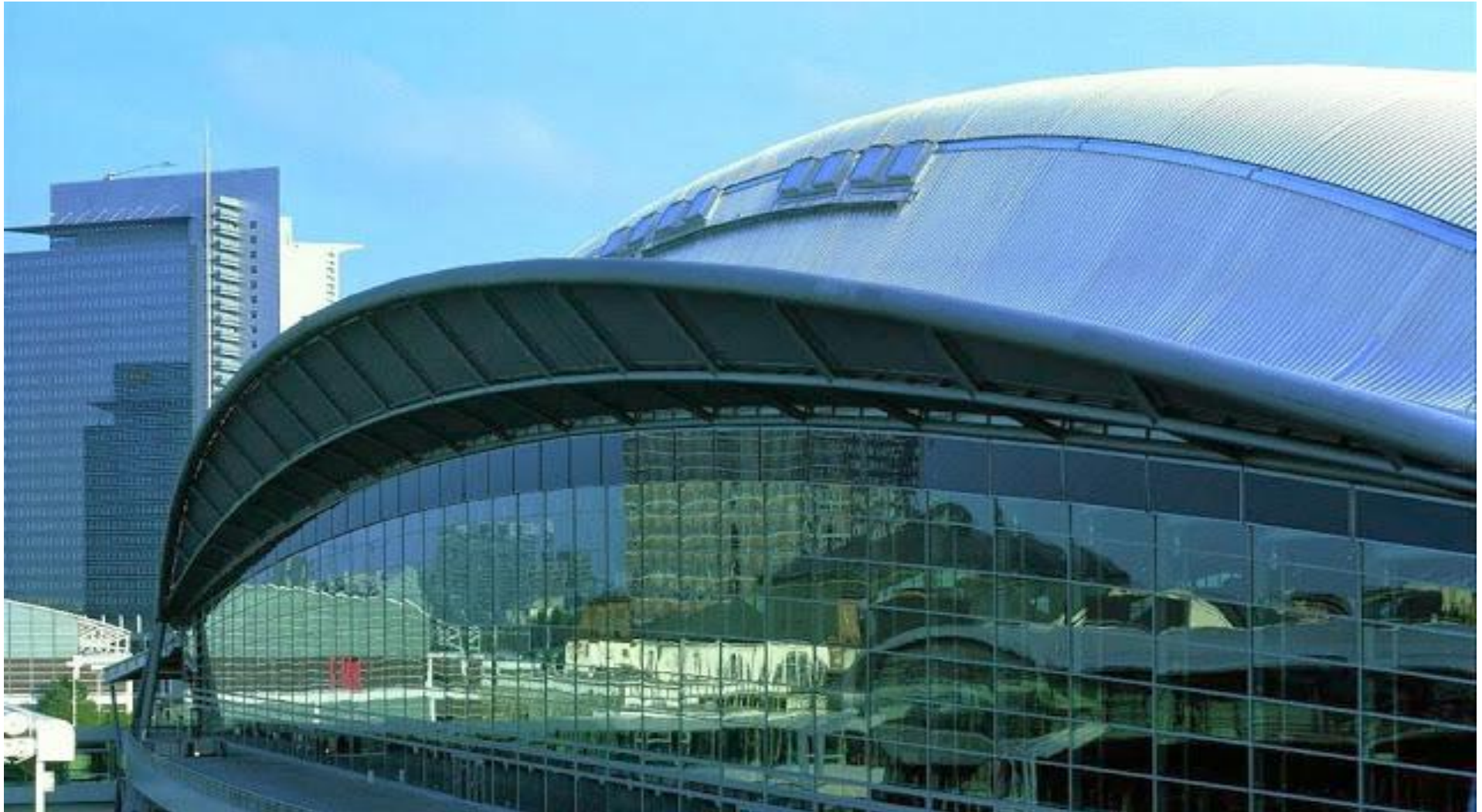
## METHODOLOGY-high performance glass

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# GREEN HOME PROCESS-RESEARCH METHODOLOGY- shading on glass

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# GREEN HOME PROCESS-RESEARCH

## METHODOLOGY- roof insulation + solar

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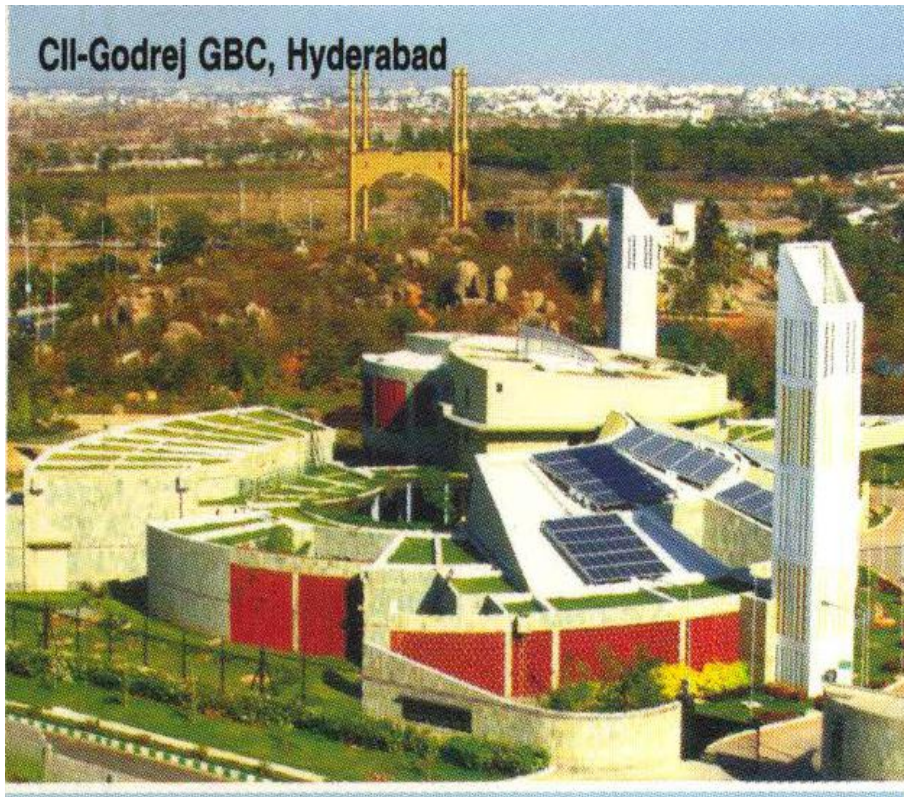




# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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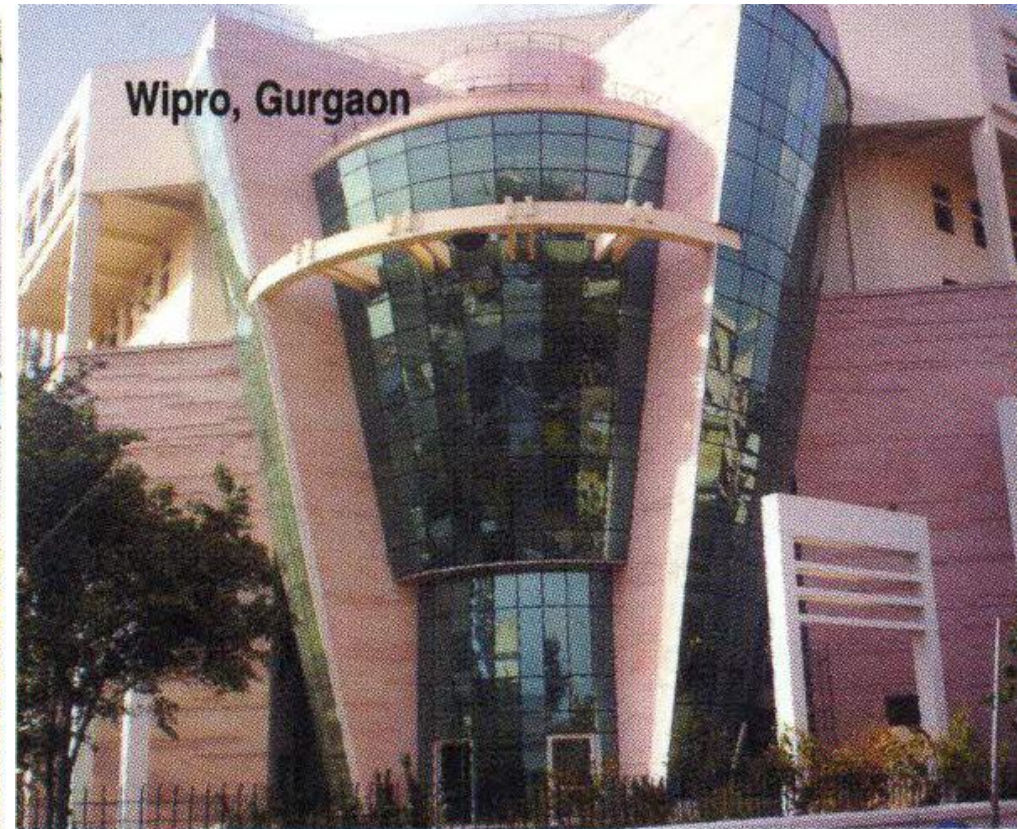
## SOME BUILDINGS EXISTED WITH AAC BLOCKS





# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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# GREEN HOME PROCESS-RESEARCH

## METHODOLOGY contd..

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### ▣ **Material:**

- ▣ Use of Waste Material /Re-Cycled Material i.e. Fly Ash, Raw Gypsum, Raw POP, Broken Tiles-Glass, Brick Bats.

IGBC Standards

% Re-Use of Salvaged Material	5%	CP1
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% Re-Use of Salvaged Material	10%	CP2
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- ▣ Minimize Construction Waste Being sent to Land Fill.

IGBC Standards

% of Waste diverted to landfill	95%	CP1
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% of Waste diverted to landfill	75%	CP2
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% of Waste diverted to landfill	50%	CP3
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# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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## Material Efficiency Contd..

### ▣ Solid Waste Management-Post Occupancy

- |                          |                     |
|--------------------------|---------------------|
| 1. Recycled Waste        | : % i.e. --- MT/Day |
| 2. Vermiculture          | : % i.e. ---MT/Day  |
| 3. Mechanical Composting | : % i.e. ---MT/Day  |

### ▣ Use of Local Material like Sand, Aggregates, Bricks

Material within 400Km

### ▣ Use of Salvage Material/Recycled Material.

# GREEN HOME PROCESS-RESEARCH METHODOLOGY contd..

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## ❑ **Indoor Air Quality :**

- ❑ Tobacco Smoke Control-Designated Area in the building.
- ❑ Day Lighting : Provide high performance glass /Sky Lighting

Achieve a minimum Day light factor

A Day Light Factor is evaluated as follows

$$D = 0.1 \times P$$

Where: D = Daylight factor

P = Percentage glazing / opening to floor area.

IGBC prescribed the standards depend on use of building.

- ❑ **Use of Exhaust System-** Moves air out of the enclosure. To remove inside heat during summer.  
as per IGBC Standards.

# GREEN HOME PROCESS-RESEARCH METHODOLOGY

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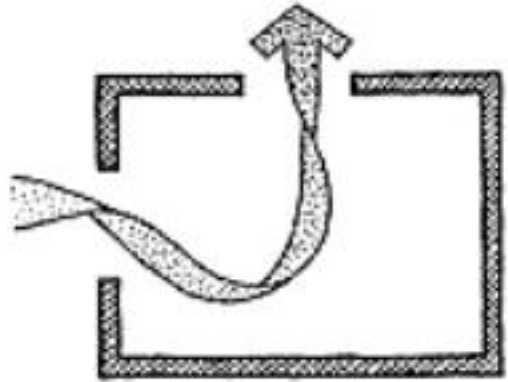
## Indoor Air Quality Contd..

- Use of Low VOC (volatile organic compound) Material.

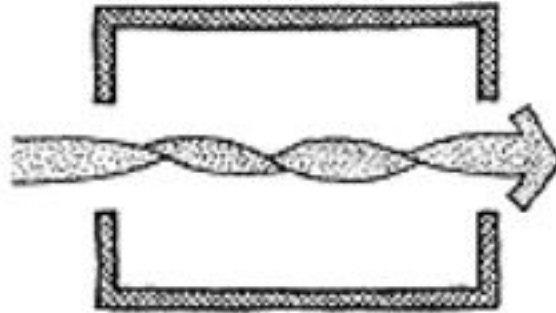
Type of material	VOC Limit
<b>Paints:</b>	
Non-flat paints	150 g/L
Flat (Mat) paints	50 g/L
Anti-corrosive/ anti-rust paints	250 g/L
Varnish	350 g/L
<b>Adhesives:</b>	
Wood flooring Adhesive	100 g/L
Tile adhesives	65 g/L
Indoor carpet adhesives	50 g/L
Wood	30 g/L



# GREEN HOME PROCESS-RESEARCH METHODOLOGY



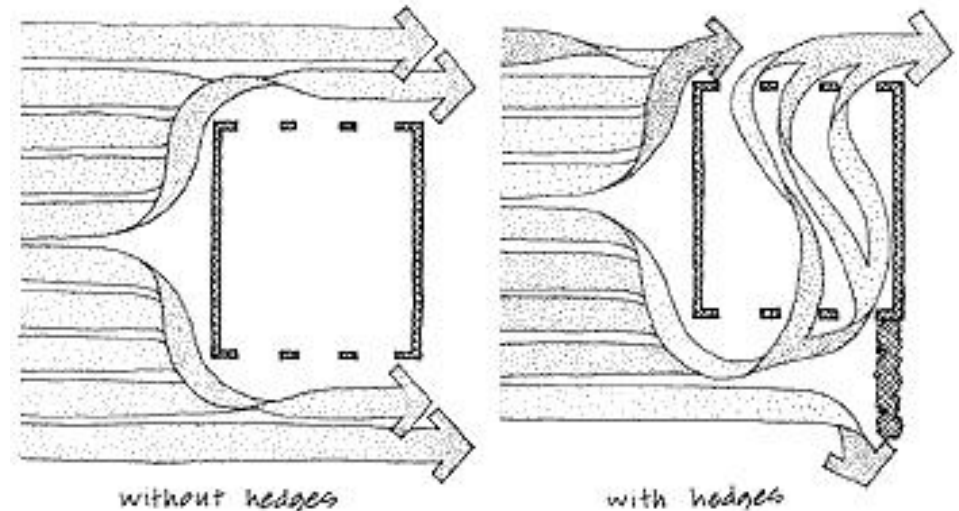
Two Openings - Adjacent Walls



Two Openings - Opposite Walls

**CROSS VENTILATION  
AIR MOVEMENT  
TYPE-I**

**CROSS VENTILATION  
AIR MOVEMENT  
TYPE-II**



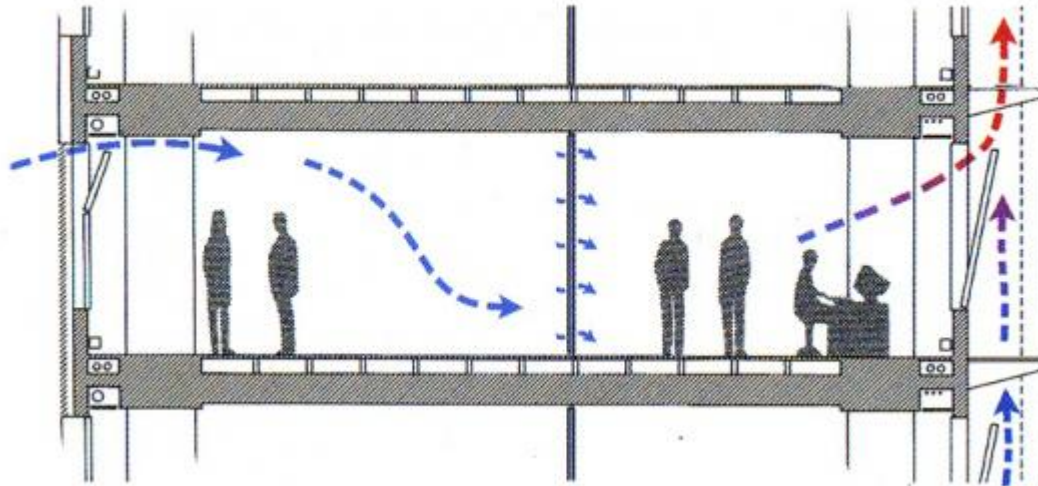
without hedges

with hedges

Modifying Wind Flow With Landscaping

# GREEN HOME PROCESS- RESEARCH METHODOLOGY

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**BUILDING  
FLUSH OUT TO  
HAVE SAFTY  
REGARDS  
AGAINST  
CONTAMINATED  
AIR**



# COST & MANAGEMENT IMPLICATION

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- ❑ Green home project costs around 10% more than conventional residential project depending upon **LEED** rating proposed for the project.
- ❑ Pay Back period is around 3 years.
- ❑ Project Construction management includes additional parameters which are cited in a preliminary certification of IGBC required to be fulfilled.
- ❑ Necessary evidential photographs like top soil preservation need to be taken along with its quantity.
- ❑ To obtain manufacturers certification for material / fixtures used in construction activities as a documentation measures.
- ❑ To maintain data like periodical BOD / COD of effluent, water balancing, SWM, use of salvage material etc.
- ❑ Achieve LEED certification as tabulated by IGBC

# RECOMMENDATIONS

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- All Govt. Institutions, Local authorities should promote idea of green building.
- Authorities should provide incentive / relief on green buildings.
- Especially Local authorities should provide in their enactment certain concessions in property taxation, Building regulation control fees, premium areas fees/demands etc.
- Electricity department should provide concessions in power billing for providing solar in homes.
- To provide relief from levy of stamp duty, registration fees for green homes.

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**THANKS**