Glass in Solar Energy: Enhancing Quality of Life and Conserving Energy

Presented by

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At Hyderabad
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Outline

Creating Innovative Solutions for a Sustainable Future

- Glass use in Green Buildings
- Glass for Solar Energy Applications
- Summary

Outline

Creating Innovative Solutions for a Sustainable Future

Glass use in Green Buildings

Green buildings…

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have minimal impact on their site and surroundings

and improve the micro-climate through better tree cover, cooler ambient temperatures, shading, etc.

Green buildings…

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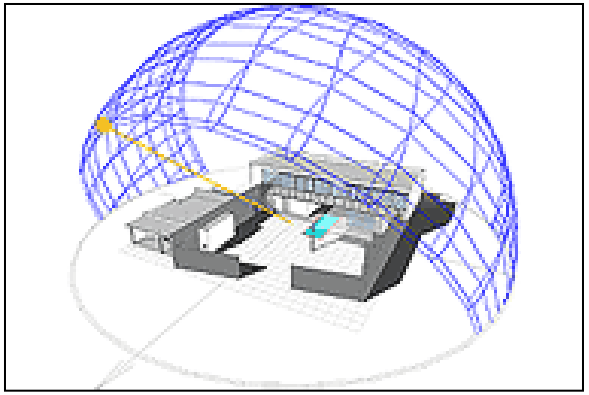
are energy efficient (minimize electricity and fuel consumption) and maximize use of renewable sources of energy (solar, wind, etc.)



and can save energy by 40-50%

Green buildings…

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Use very less water and promote recycling and reuse of water. Enable solid waste segregation, management and generation of resources from wastes.

Save water by up to 40% and promote maximum recycling and reuse of waste.

Green buildings…

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- Have minimal negative impact on people.
- Catalyse healthy and productive work environment.

GRIHA - Green Rating for Integrated Habitat Assessment

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Tool to facilitate design, construction, operation of a green building, and in turn …measure "greenness" of a building in India

सत्यमेव जयते

Ministry of New and Renewable Energy, GoI

GRIHA

"What gets measured gets managed"

Highlights

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Set of 34 criteria

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

- **51 - 60** ★
- **61 - 70** ★★
- **71 - 80** ★★★
- **81- 90** ★★★★
- **91- 100** ★★★★★

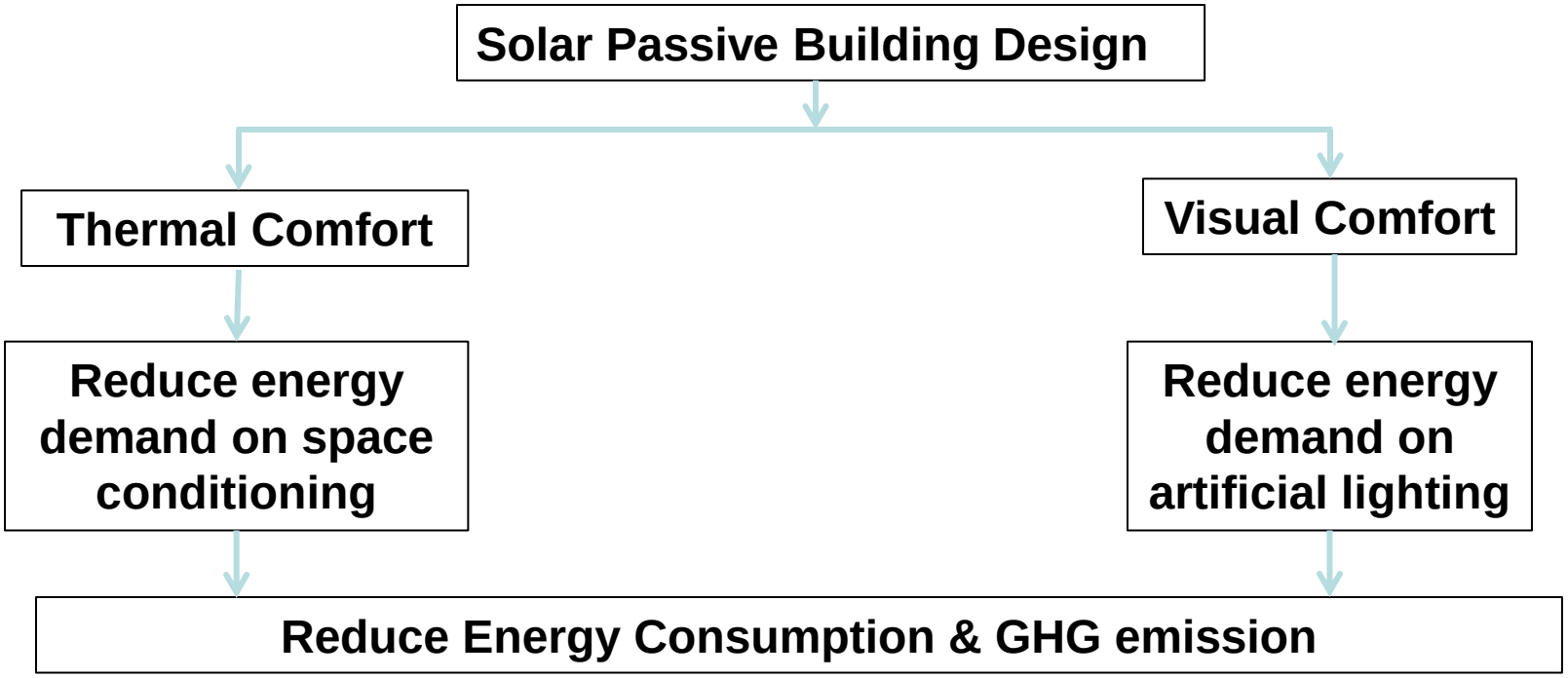
GRIHA

Criterion No. 13

Optimize building design to reduce the conventional energy demand

Objective

To apply climate responsive building design measures, including day-light and efficient artificial lighting design, in order to reduce the conventional energy design.



13.1 Commitment

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13.1.1 In order to optimize the building design appropriate climate responsive design strategies should be adopted, such as:

- Optimum orientation
- Internal space arrangement (buffer zones)
- **Allocation of building opening**
- **Sizing of openings** (limitation of window-wall ratio and skylight roof ratio)
- Appropriate shading device (facade shading and fenestration shading)
- Adequate daylighting (optimum daylighted area and daylight factor)

Possibility of achieving maximum 8 points.

Criterion No. 13.1.1.2 Maximum openings on N & S

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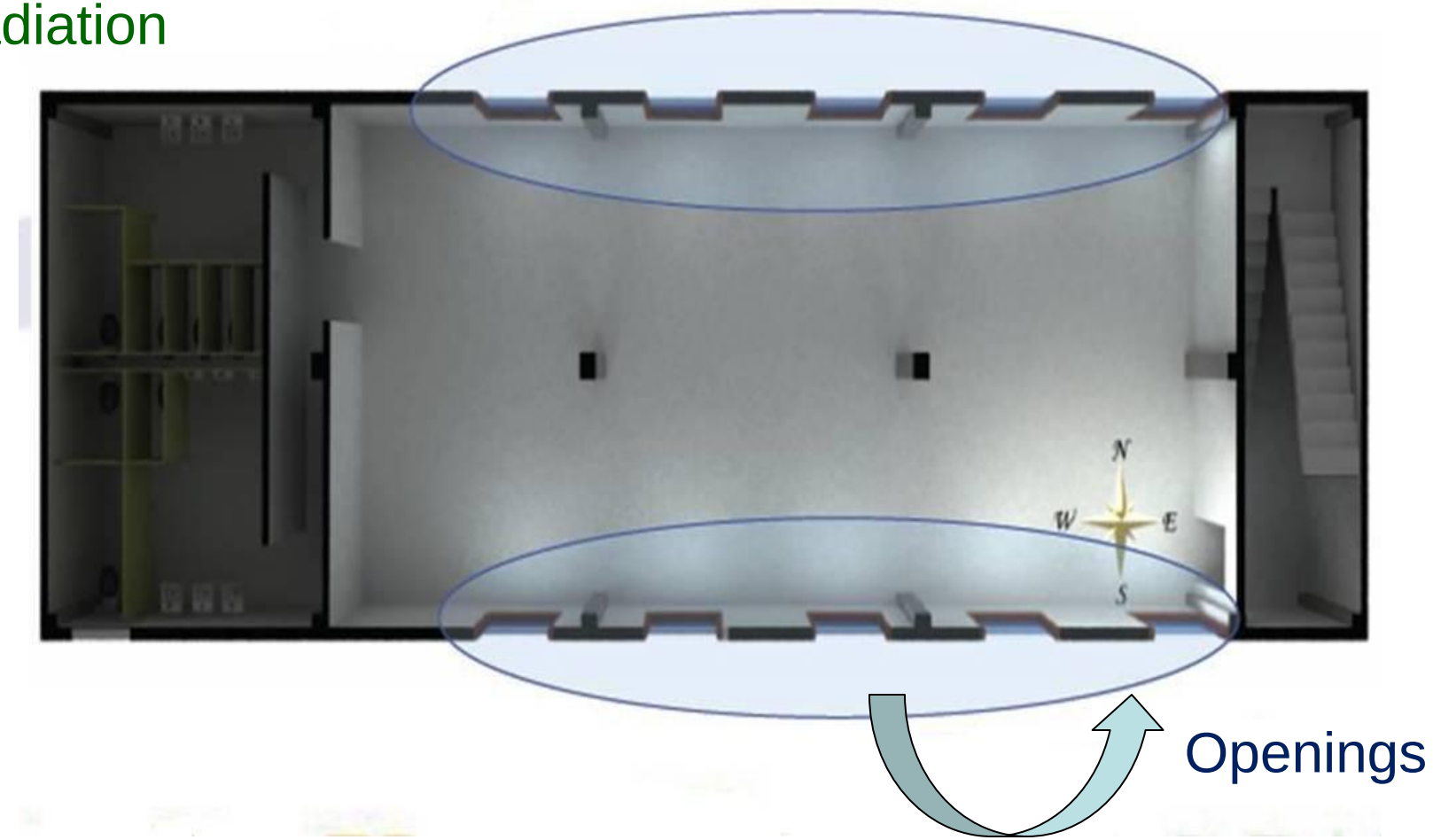
Maximum openings should be provided along the north and south facades to avail maximum daylight and minimum solar radiation



13.1 Commitment

- 13.1.2 The WWR (window to wall ratio) is limited to a maximum of 60% of gross wall area and the SSR (skylight to roof ratio) is limited to a maximum of 5% of gross roof area (as prescribed in Energy Conservation Building Code (ECBC)-2007).
- 13.1.3 Demonstrate that the effective SHGC (Solar Heat Gain Coefficient)* of the fenestration (accounting for glazing, overhangs and/ or vertical fins) is compliant with the maximum SHGC requirement prescribed by ECBC-2007. (Refer Table-13.1)

Table-13.1 SHGC Requirement for vertical fenestration & skylight

Climate	Maximum SHGC			
	WWR ≤ 40%	40% < WWR ≤ 60%	0% < SRR ≤ 2%	2.1% < SRR ≤ 5%
Composite	0.25	0.2	0.4	0.25
Hot and Dry	0.25	0.2	0.4	0.25
Warm and Humid	0.25	0.2	0.4	0.25
Moderate	0.4	0.3	0.61	0.4
Cold	0.51	0.51	0.61	0.4

Window to Wall Ratio (WWR)

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- Window-Wall-Ratio (WWR) : The Window Wall Ratio refers to the ratio of the total fenestration area to the gross wall area.
- ECBC in a prescriptive approach recommends a maximum WWR of 60%.

U-Value threshold specified in the ECBC

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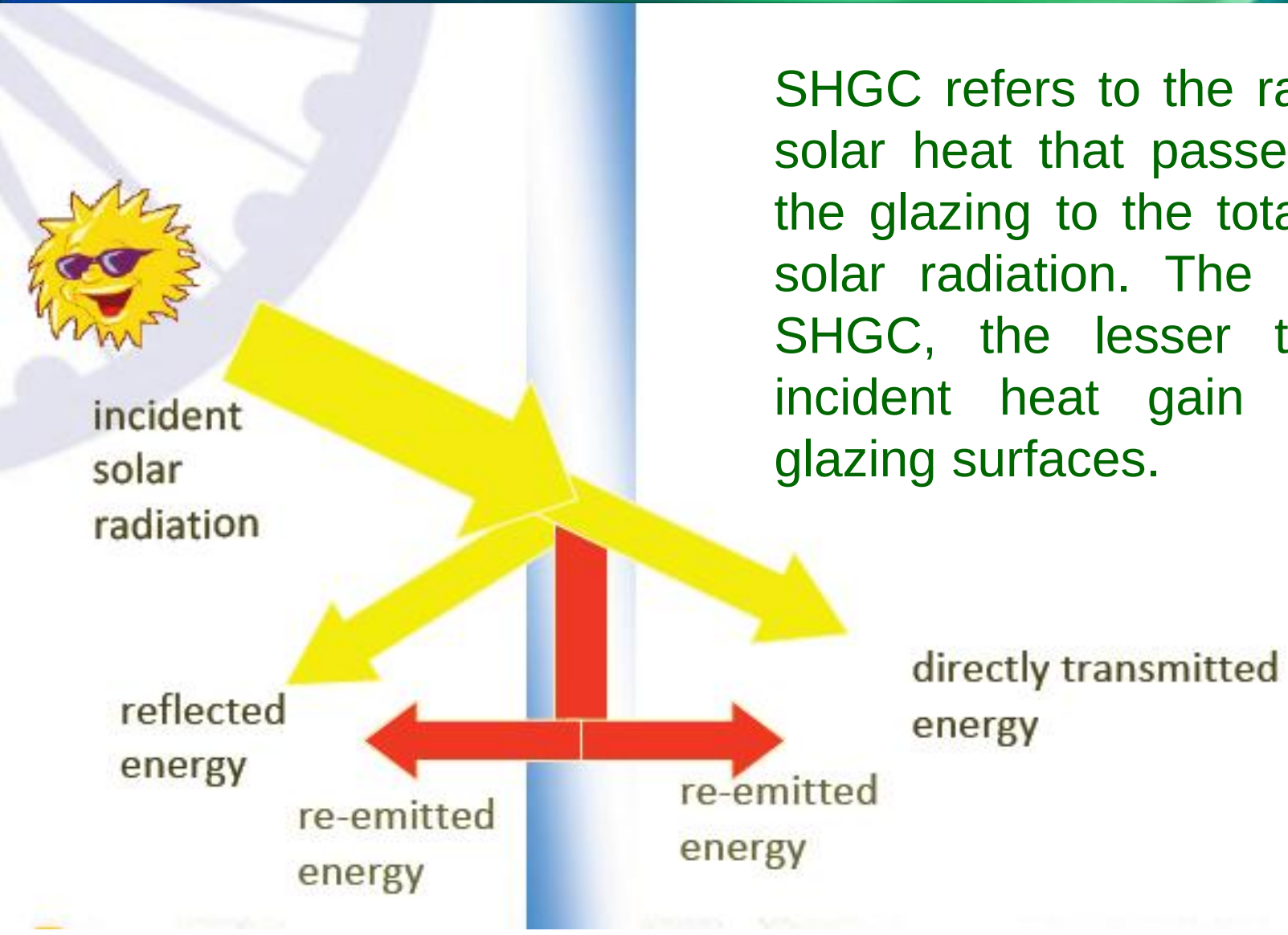
GLASS

Climate	Maximum U-factor (W/sq.m.-°C)
Composite	3.3
Hot and Dry	3.3
Warm and Humid	3.3
Moderate	6.9
Cold	3.3

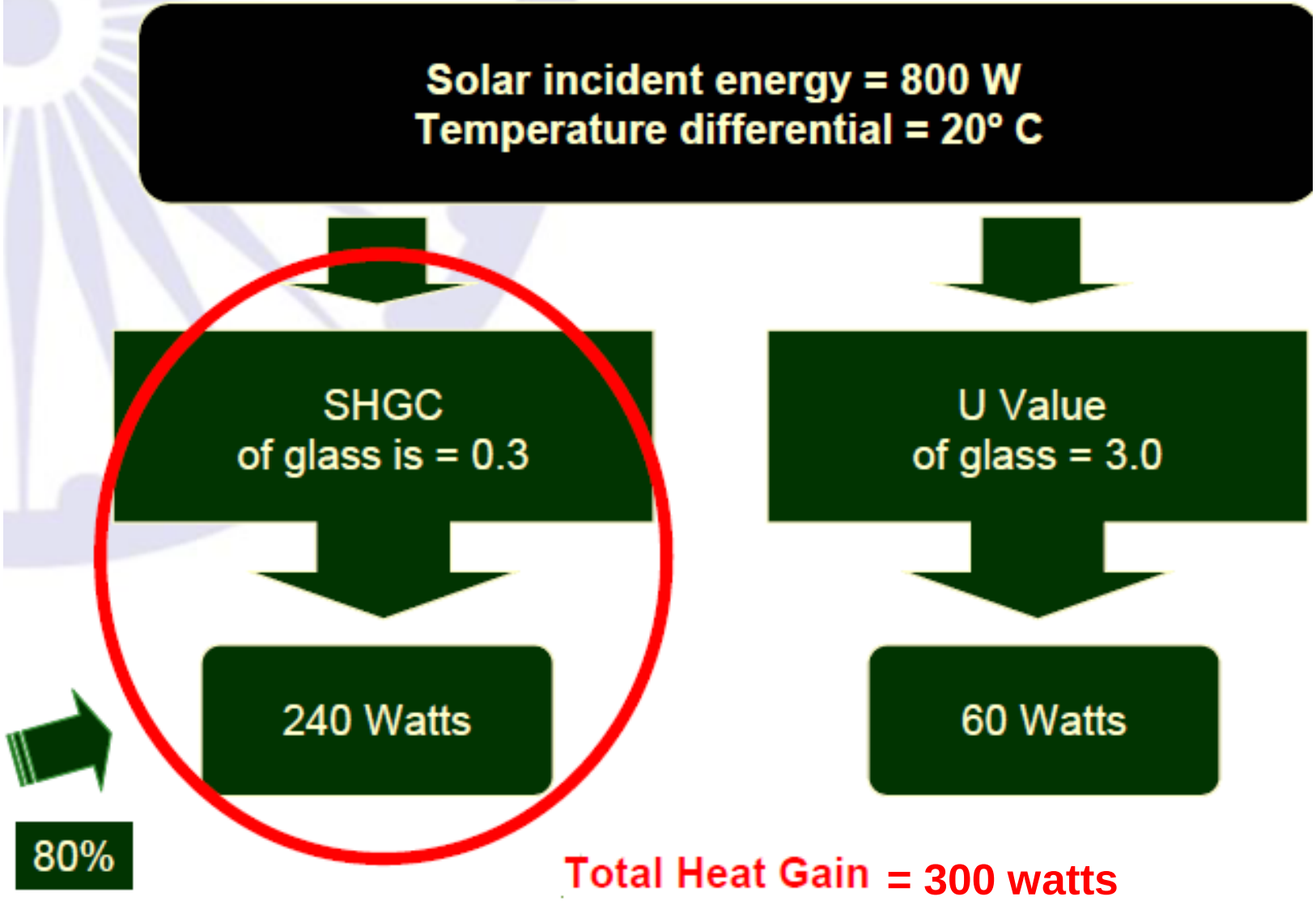
U-value is the rate of heat flow through a unit area building component (in this case) through an overall unit temperature difference between the two sides of the component. The lower the U value, the lower is the heat gain/loss in the building.

Solar Heat Gain Coefficient (SHGC)



SHGC refers to the ratio of the solar heat that passes through the glazing to the total incident solar radiation. The lower the SHGC, the lesser the direct incident heat gain from the glazing surfaces.

Why SHGC is important ??



Available products in market

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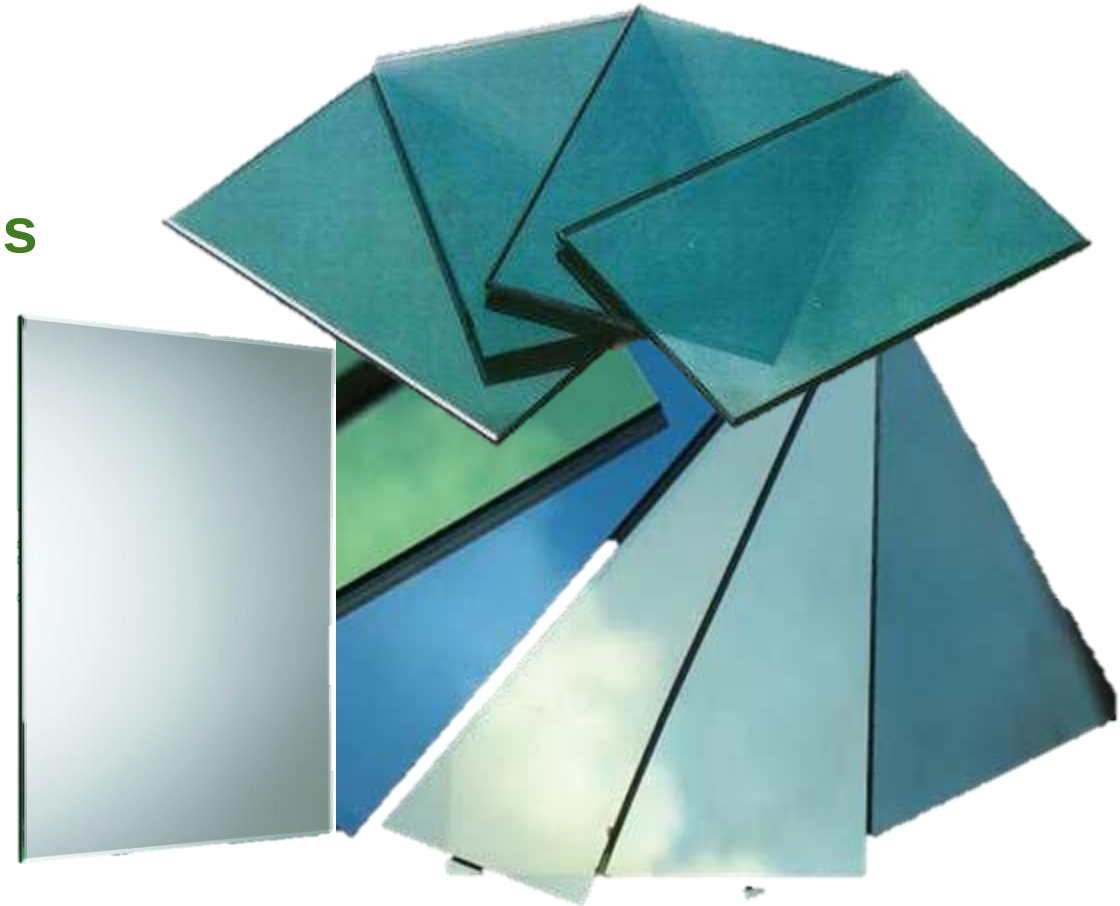
- Reflective glass with coating
- Low E glass (thermal insulation glass)
- Solar thermal glass
- Solar control glass
- Vacuum coated glass

…..and so on



Criterion 17

Use low-energy material in interiors

Objectives

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- To use low-energy/recycled materials/finishes/products in the interiors, which minimize the use of wood as a natural resource or utilize industrial waste.

For instance: Use of glass, which is manufactured using waste glass cullets saves about 26% of the total energy required for procuring and transportation of raw materials.

Possibility of achieving maximum 4 points.

Outline

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Glass for Solar Energy Applications

Glass for solar industry

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- **Glass is an essential component of solar energy devices**
  - **Solar energy devices can be classified as**
    - **solar Photovoltaic devices**
    - **Solar Thermal devices**
- **Three major uses**
  - **As transparent shield**
  - **As reflective mirror**
  - **As refractive lenses**

Ref for pictures (L-R Clockwise)
http://solartribune.com/evacuated-tube-solar-hot-water
http://www.solarpanels.net.in
http://www.solarcentralpower.com/photo-media.html
http://www.sunraysolar.com/collectors.php

Solar Energy in India

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- Solar energy input on India's landmass is more than 5000trillion kWh per year
- So far about 1000MW capacity solar power plants/ systems installed
- Jawaharlal Nehru National Solar Mission
  - **Targets 20GW capacity solar plants by 2022**
    - Estimated market size for glasses more than 200,000m^2
  - **20million m^2 of solar collectors by 2020**
    - Equivalent area of flat glass cover for solar collectors

Requirements of solar glasses

- Clear transparent glasses with transparency >90%
- Low iron toughened glass
- Textured pattern on one side for multiple reflections which improve transmissivity
- Most applications need 3-4 mm thick glasses

Summary

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- Glass plays an important part in buildings both as structural and glazing material
- Glass is also an integral part of most of the solar energy devices.
- With launch of GIRHA rating system for ecofriendly buildings and JNNSM for developing solar energy markets, the market for specialized glasses for these applications is likely to increase many fold in coming years

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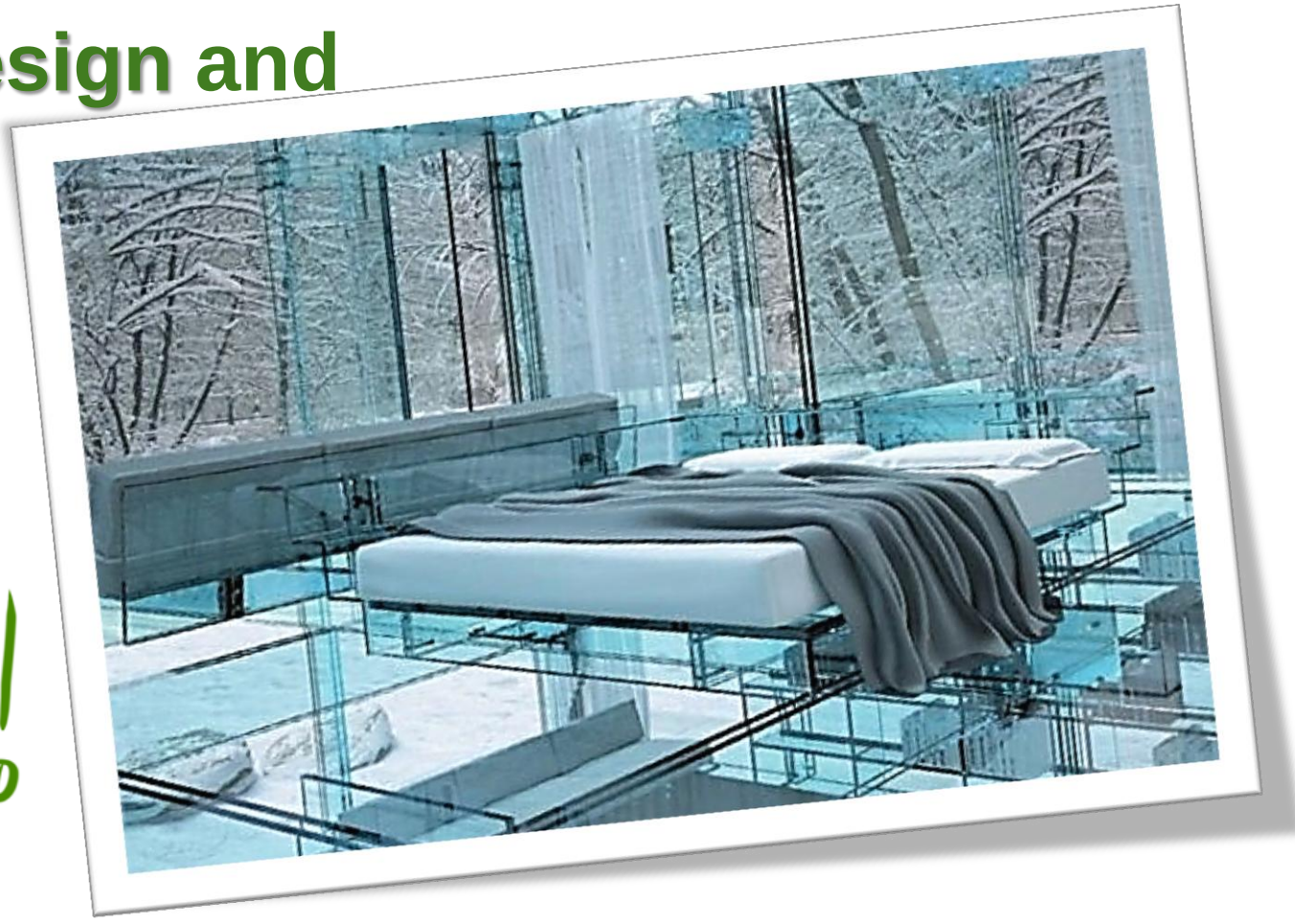
Glass was invented 5500 years ago…and is still the epitome of design and architecture.



Thank You!