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# **Fastest way to Go Green- Innovation**



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**Solutions**

# Growing awareness



In India, the construction sector is growing at 13% and real estate at a stunning 30%.

“The building and construction sector represents over 111 million people directly employed worldwide with 75% in developing countries.”

Taking into account its entire lifespan, the built environment is responsible in each country for:

- 25 - 40% of the total energy use
- 30 - 40% of solid waste generation
- 30 - 40% of Global Green House Gas Emissions.

**Reduce the use of resources.**  
**Make Green Buildings.**



ITC Royal Gardenia, Bangalore

# Do these buildings on right look **Green**?

"A green building is one which uses **less water, optimizes energy efficiency, conserves natural resources, generates less waste and provides healthier spaces** for occupants, as compared to a **conventional building.**"

TECCI IT Park Chennai



Green Boulevard NOIDA



How would we raise standards of **Green Buildings?**

**INNOVATE**



**Well that's happening already. In fact it has always been there.**



# How are we doing about Building envelope?



Three of such materials  
are-

Brick

RCC

Glass





## Glass and other Materials

	<b>Glass</b>	<b>Brick</b>	<b>RCC</b>
Compressive strength ( MPa)	1000 (Tempered Glass)	80 (Best quality Fire Burnt Clay Brick)	60
Tensile Strength (MPa)	200	2.8	10
U value (W/(m <sup>2</sup> K))	1.1 (Low-e)	1.6 (Cavity Wall)	8.9
K value (W/(m K))	0.98	0.6	0.3
Embodied Energy (MJ/Kg)	15.9	2.5	2.0
Recyclability	Fully	No	No

# Apple to Apple

Compare 6mm thick brick wall  
with 6mm thick glass.



# Glass



- The problem here is-
  - Glass doesn't have any thermal mass as compared to other walling materials because of the thin sheet used for practical reasons.
- Because of this- there is no time lag
- Hence the perception of heat exchange by humans is more.
- Yet, Glass is the most versatile and widely used material for building construction.



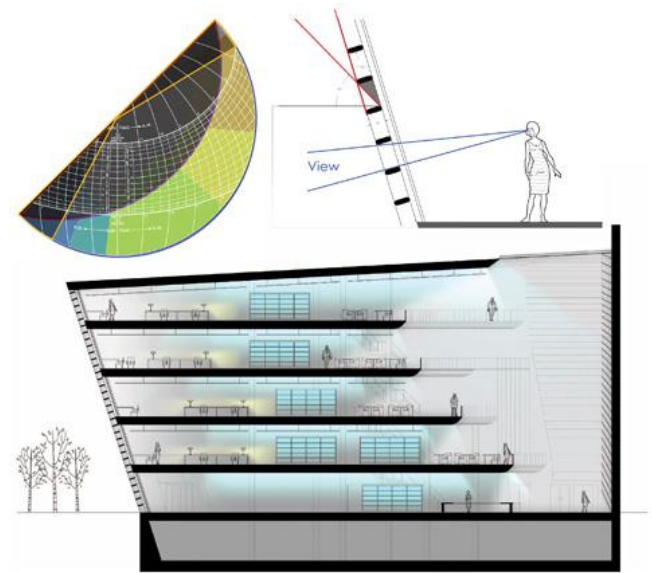
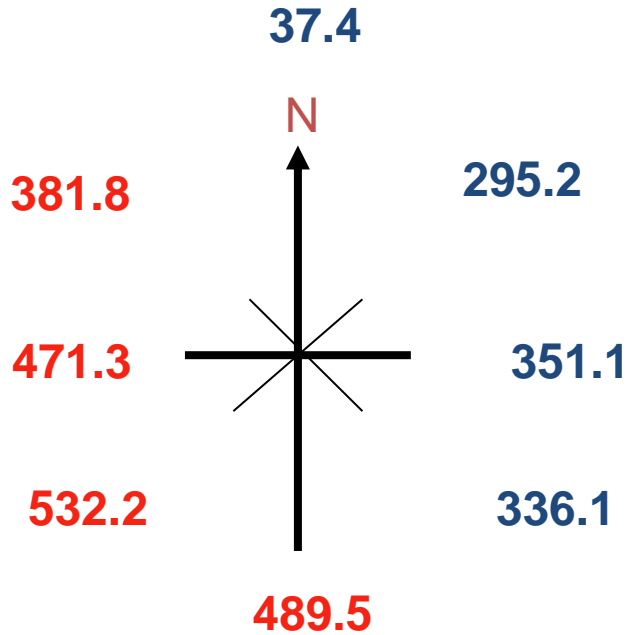
$$\begin{aligned} \text{RHG} &= \text{SHGC} \times \text{SI} + \Delta T \times U \\ &= 0.25 \times 784 + 8 \times 2.8 \\ &= 196 + 22.4 \\ &= 89.74\% + 10.26\% \end{aligned}$$

As a standard procedure, for calculating RHG of a glass assembly, besides SHGC (Shading Heat Gain Coefficient) and U value, both of which are integral properties of Glass and keep varying, values for SI (Solar Intensity) and  $\Delta T$  (Temperature difference as per the environmental conditions) are needed.

Both SI and  $\Delta T$  are constant for different regions in the world. For India, SI is taken to be 784 W/m<sup>2</sup> while  $\Delta T$  is taken to be 8°C (32-24).

**Hence for all Indian contexts, we advise to use glass with lower SHGC rather than going in for low U value and it barely effects the heat gain through window.**

- Orientation of glazing
- Shading- External
- Inclination of Glazing
- Coating



- Coated Glass-
  - Solar Control Glass
  - Solar-Thermal Control Glass (Low-e)
- Electrochromic Glass
- Thermochromic Glass
- Photochromic Glass



- Building Integrated Photo Voltaic (BIPV)
- Photo Voltaic Cells (Solar Cells)
- Dish Sterling
- Parabolic Trough
- Fresnel Lens



# Conclusions



- Each material has its own advantages and disadvantages
- Designer has to exploit these properties w.r.t. design.
- Besides making net zero buildings, we must approach towards making energy-positive building which is possible only with the use of glass.
- Glass is the most versatile material available with us today.







Welcome to a world which  
enables you to do more

**Thank you**  
for your time