

Role of Glass in Green Architecture

Green building design criteria emphasizes the energy-efficient performance of fenestration materials and maximum use of natural daylight. Given this background, Glass is an indispensable material for green building. It has a wide range of functional benefits. Its transparency allows day-lighting of the interiors and integrates the interiors with the exteriors. Studies have proven time and again that this substantially improves the productivity and health of the occupants of the building.

Glass is completely recyclable and non-toxic in nature. It satisfies all the ecological parameters of being the most sought after “green” building material in Green Buildings. Moreover it harmonizes a structure with its environment.

Glass has varied “Green” benefits of which, some of them are:

- Day-lighting - The use of glass brings in lot of light that helps in giving a high amount of natural day lighting instead of depending solely on artificial lighting thus reducing considerably electricity consumption.
- Blending interiors with exteriors (Views) - Glass facades give a spectacular view of the outside world from the cozy interiors.
- Recyclability - Glass being recyclable satisfies the important parameter of being a “Green” building material.
- Achieving energy efficiency - High performance glass helps in controlling the solar and thermal heat in the interiors and helps to maintain the temperature at its minimum best and in turn helps to tone down the air-conditioning expenses.
- Innovative application - Being very flexible building material glass helps to satisfy and capture an architect's utmost imagination in its shape and form.
- Controls noise: Double glazed glass facades help in achieving a high degree of acoustic comfort by keeping away noise penetrating from the exteriors to the interiors thus ensuring a calmer atmosphere inside.
- Self Cleaning: The future belongs to self-cleaning glass which keeps itself clean on its own and brings out an ever sparkling effect.

Glass and LEED Rating

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System, developed by the U.S. Green Building Council (USGBC), provides a suite of standards for environmentally sustainable construction.

The LEED rating system for Green buildings has six major areas of which four have the potential to be tapped through appropriate usage of High Performance Glass in design:

- Sustainable sites
 - Water efficiency
 - Energy and atmosphere
 - Materials and resources
 - Indoor environmental quality
 - Innovation and design process
- 
- High Performance
Glass Impact

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ENERGY & ATMOSPHERE (EA)

Optimize Energy Performance

The building facade, windows, doors, and skylights can be designed with high performance glass to meet the desired solar heat gain coefficient and U-value requirements. The use of glass can let in adequate daylight resulting in reduction of artificial lighting costs. A complete energy simulation for the building is possible nowadays and helps to improve the energy performance of the design.

MATERIALS & RESOURCES (MR)

Regional Materials

The distance from the glass manufacturing/fabrication facility to the job site (within 500 miles radius) is a major factor in gaining points under the Regional Materials Credit. The wide network of Saint-Gobain Glass' processors and fabricators helps under this category.

INDOOR ENVIRONMENTAL QUALITY (EQ)

Daylight and Views

High Performance glass from Saint-Gobain helps to blend the twin actions of achieving desired levels of daylight and transparency to enable external views. The letting in of natural light helps cut down on the artificial lighting costs.

INNOVATION & DESIGN PROCESS (ID)

Innovation in Design

Saint-Gobain Glass addresses needs such as Acoustic Insulation, Self-cleaning etc apart from the prescribed requirements of Energy Efficiency, Recyclability and Day-lighting. High performance glass when used in Double Glazed panels or as Laminated units provide higher degree of Acoustic Insulation that ward off unwanted noise from the external atmosphere. Saint-Gobain also offers Self-cleaning glass that can keep itself clean without any maintenance hassles.

Thus the overall innovative use of High Performance Glass from Saint-Gobain in a building can fetch upto 13% of the overall points in the LEED Rating system.

Choosing Glass

In tropical countries like India, one needs to be careful in selecting the right glass solution. Selecting the right kind of product is critical in maximizing the benefits possible from glass.

Broadly glass can be chosen according to the performance needs and the aesthetic needs. For a Green Building it is important to choose a glass solution that gives high performance without compromising on aesthetics.

PERFORMANCE CRITERIA

Optimum Light Transmission (LT)

As India is a tropical climate, we have abundant sunlight. Ironically the bill on artificial lighting contributes 20% to the total spend on electricity. The facts in reality are :

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- The lux level from direct sunlight is around 1,13,000 Lux.
- The lux level in shade is around 9,000 Lux.
- Brightly lit interiors which are conducive for working require 500 Lux.

High Performance Glass helps in cutting down excessive glare and brings in abundant natural light thus reducing the dependence on artificial lighting.

Energy Efficiency

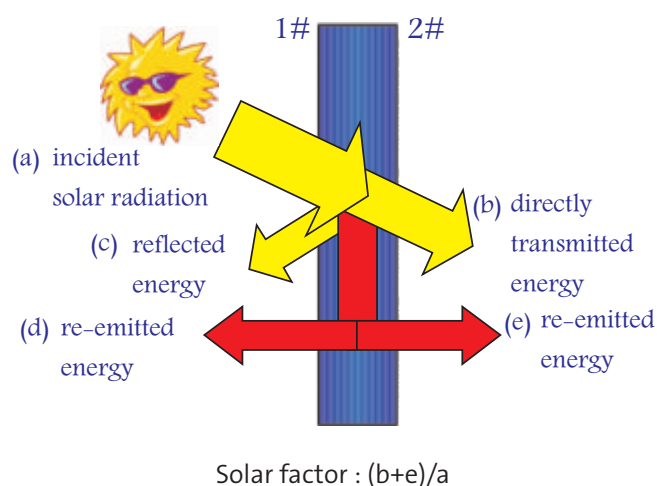
In climatic conditions like India, 80% of the total heat gain is due to direct solar radiation and the rest is due to temperature difference between the exteriors and interiors. Thus to reduce the overall Relative Heat Gain (RHG) in tropical climates, it becomes necessary to curtail the incoming solar radiation by the use of glass with high performance solar “control” coating. Contrary to this, in cold climates the emphasis is on glass with low-emissive coatings to reduce the rate of heat loss from interiors to exteriors.

The total heat gain is measured in terms of Solar Factor and U-value and is expressed as a sum of these two components.

Solar Factor :

Heat gain on the inside of the building due to direct solar radiation incident on glass is measured through the solar factor of glass.

Solar Factor: It is the sum of percentage of incident solar energy directly transmitted and incident solar energy absorbed and re-emitted inside.



U-Value

Heat gain due to temperature difference is expressed by U-Value of a glass.

U-Value: It is the amount of heat transferred (lost/gain), due to a temperature differential of 1°C between inside and outside per square meter.

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The best energy performance is obtained from a glass solution which is lower in terms of Solar factor and the U-value. Thus the best option for tropical climates, is to use glass with high performance solar control coatings double glazed with low-emissive glass to reduce the overall heat gain.

AESTHETIC NEEDS

The High Performance Energy efficient glass solutions from Saint-Gobain have also been categorized under the various Houses of Color to enable comparison of the products based on aesthetic considerations.

The Houses of Color are:

1. Neutrals
2. Metals
3. Blues
4. Greens
5. Blue-Green

Shortly, India would have stringent regulations to conserve energy by way of the Energy Conservation Building Code (ECBC) that would impact upcoming buildings and buildings going in for renovation. Saint-Gobain Glass has a wide range of ECBC Compliant products.

Green Buildings by Saint-Gobain Glass

Olympia Tech Park, Chennai

Design Intent:

Relative Heat Gain (RHG) of lesser than 150 W with Solar Factor and U-Value lower than 0.20 and 1.7 W/sqm respectively was required from the glass solution.

Glass Solution Used :

SGG Cool-Lite Titanium Blue double glazed with SGG

Planitherm Pristine White to give a very low solar factor of 0.15 and U-value of 1.5 W/sqm resulting in an overall RHG of 130 W was specified and used for the Green Building.

Novel Architectural design resulted in increased daylighting and blending interiors with the exteriors.



ITC Green Center, Gurgaon



Design Intent :

Overall energy efficiency of the façade with optimum light transmission was required. Particularly on the Northern side, the glass solution was required to give a higher light transmission due to the orientation of the building and at the same time control the temperature difference.

Glass Solution Used :

SGG Cool-Lite Turquoise double glazed with SGG Ekologik was specified and glazed to give a very low solar factor and U-value to provide an energy efficient solution with optimum light transmission.

Specifically for the northern side of the facade SGG Parsol Green double glazed with SGG Ekologik was used to enable higher light transmission and at the same time provide the required U-value to maintain the temperature differential from the interiors to the exteriors.

Grundfos Pumps, Chennai



Design Intent:

Maximum daylighting was intended without depending on artificial lighting. An energy efficient skylight was called for which could let in natural light and at the same time cut down the heat and reduce air-conditioning expenses. Moreover the external views needed to form at least 90% of the occupied areas.

Glass solution used:

SGG Antelio Plus Emerald Glaze was used for the energy efficient skylight that allows abundant

natural light to the interiors and cuts down the heat. This resulted in absolute non-usage of artificial lighting for the office spaces for the entire part of the day. The air-conditioning expenses also have been kept at their minimal best due to the energy efficient glazing. The external views now form at least 95% of the regularly occupied areas.

This green building consumes 25% less energy, compared to conventional building by adopting above measures.

Wipro Technologies, Gurgaon

Wipro Technologies Gurgaon Development Centre is the greenest building in India and second greenest building in the world. The building has received 57 points and is Platinum rated.

Wipro Technologies, Gurgaon is designed by the eminent architectural firm, M/s Vidhur Bharadwaj & Associates from Delhi.

Demographics:

Plot size: 1.12 Acre

Building floor space: 175,000 sqft (incl of basement)

Benefit from proper use of glass:

Glass had contributed the following valuable points on LEED Rating:

1. More than 90% of the occupants in Wipro Technologies building, get daylight and views of the outside which gave the building 2 points in Indoor Environment Quality.
2. As per green building norm of Material & Resources:
 - a. 20% of the total material should be locally manufactured. In the case of Wipro Technologies



building the glass was procured locally. This gives 1 point on the ratings scale.

b. Glass has 15% recycle content plus it is 100% recyclable. Recycle content has 2 points and Wipro got both.

3. By reducing energy requirement of the building by 50% on the base case, Wipro could get 10 points.

Wipro Technologies reduces 51% energy on the base case. They opted for high performance glass which reduced the energy requirement by 5.6%.

Summing up, in the case of Wipro Technologies, glass contributed 2 clear points and 13 combined points.