

Building Energy Efficiency

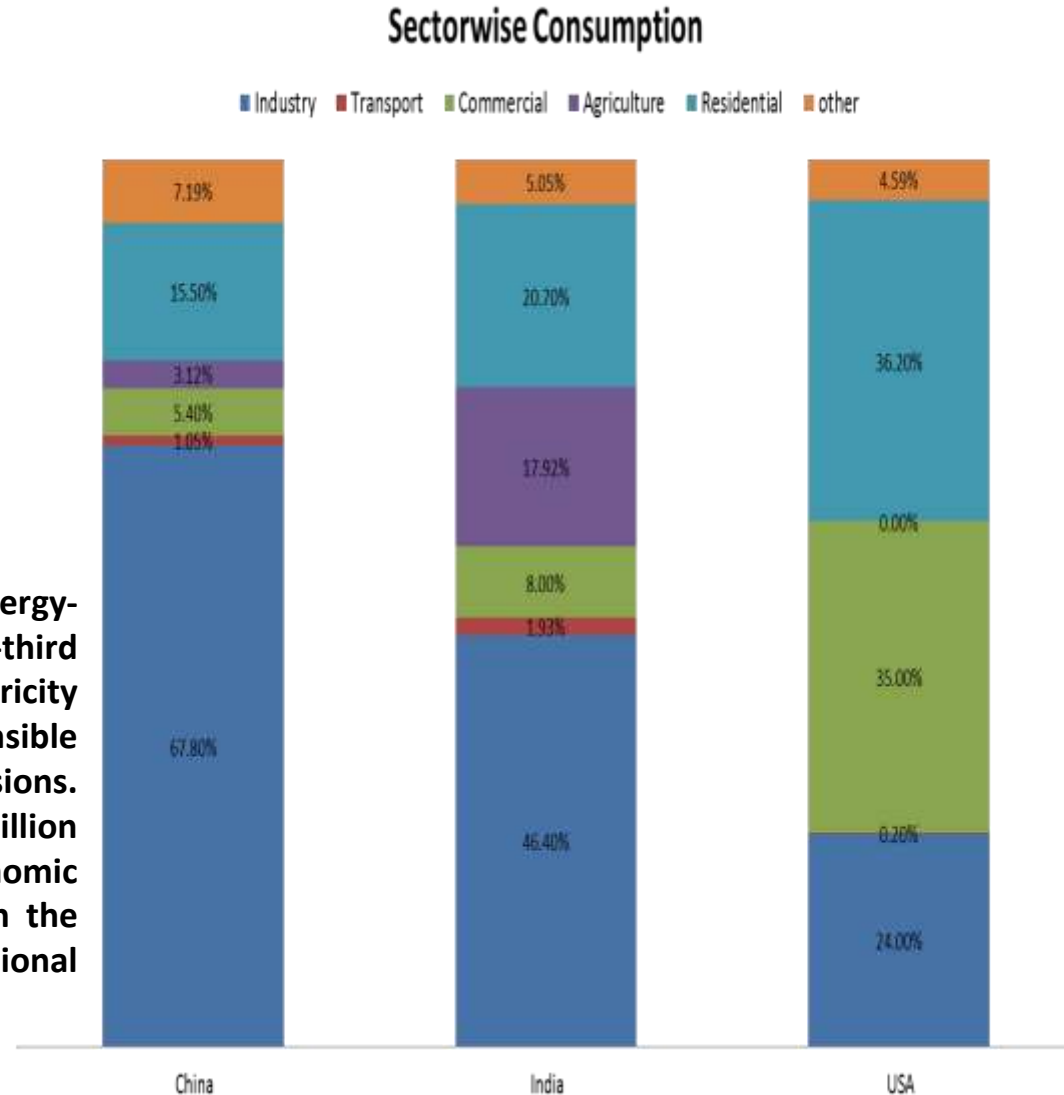


Asahi India Glass Limited

Energy Consumption Globally

Consumption/year	
Rank	Country
1	US
2	China
3	Japan
4	Russia
5	India

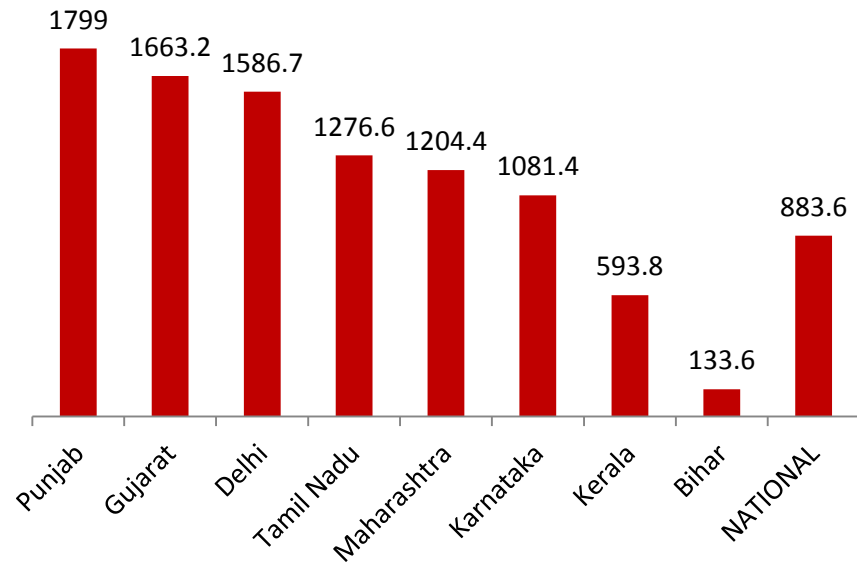
Buildings represents one of the significant energy-consuming sector in the economy, with over one-third of all final energy and half of global electricity consumed there. As a result, they are also responsible for approximately one-third of global carbon emissions. With an expected population increase of 2.5 billion people by 2050, and given improvements in economic development and living standards, energy use in the buildings sector is set to rise sharply, placing additional pressure on the energy system.



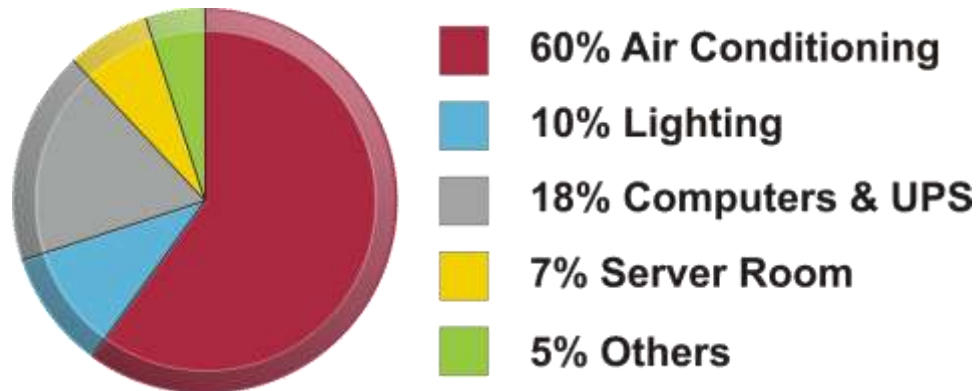
Building Energy Consumption

Daily consumption per capita	
kWh/capita	Country
51.5	US
39.25	China
33.54	Japan
28.39	Russia
2.02	India (23)

Per-Capita Consumption (kWh)



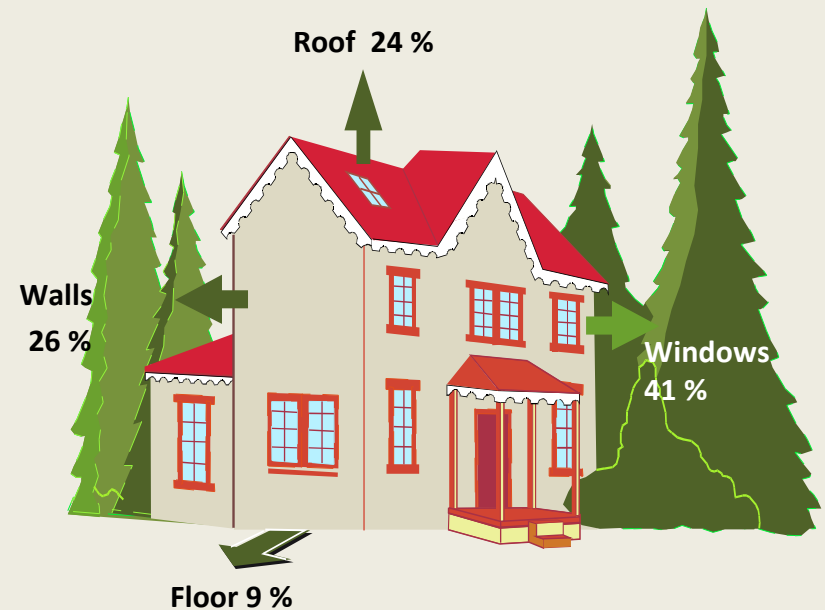
Power consumption break up in Typical office building



Causal effect in Buildings

- ✓ Building typology
- ✓ Location.
- ✓ Landscape.
- ✓ Orientation.
- ✓ Shading.
- ✓ **Façade Material selection.**
- ✓ Insulation .
- ✓ Internal layout.
- ✓ The positioning of openings to allow the penetration of solar radiation, visible light and for ventilation
- ✓ Active designing

Heat Gain/loss through Facades



Phenomenal façades



Clear Glass

Tinted Glass

Coated Glass

Hard Coat

Soft Coat/MSVD

Mirror

Lacquered

Other Glass

Frosted

Smart Glass



Concrete Building with wood windows



Clear or Tinted Glass



High Performance Glass



Smart Buildings with High Performance Glasses

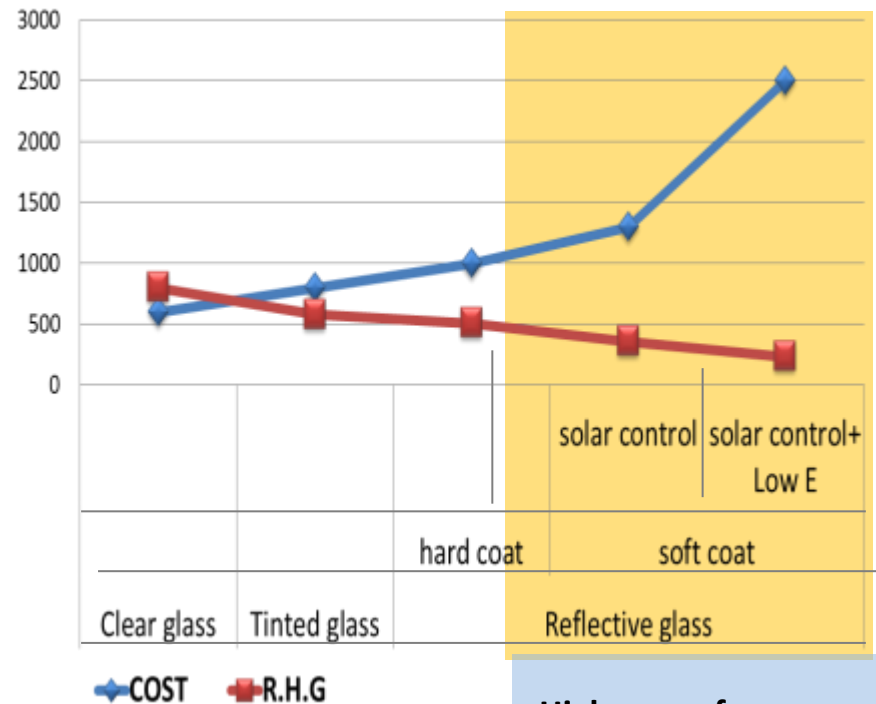
“Façades are to a building what first impressions are to people”

“A building’s character is determined by its architectural façade and is therefore a crucial design and construction element responsible for setting the ‘tone’ of a building.”

Glazing selection Parameters

Parameters	Importance
Aesthetic	Enhances look of the building
Energy Efficiency	It is a combination of lighting & cooling energy saving
Improved Day-lighting	Reduces artificial lighting requirement by using glazing
Glare Reduction	It can defeat the purpose of using glass

Glazing Cost and Performance :



Glass	Colour	VLТ	IR	ER	SF	SC	U value	RHG
A	Shade	%	%	%	%		W/m2	W/m2.k

High performance glasses are innovative products which are **expensive but cost beneficial** as the amount of heat gain is less and hence more energy saving.

Real-Life Case Studies



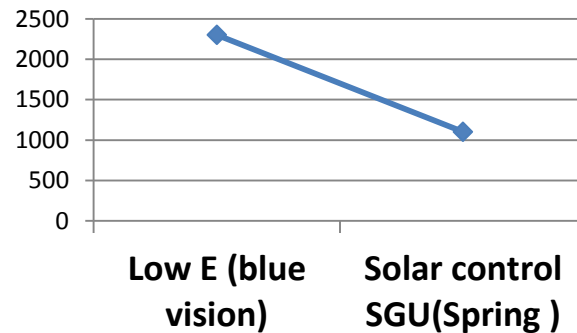
How expensive Glazing is cost beneficial?

Case 1: Office building, Noida WWR > 60%

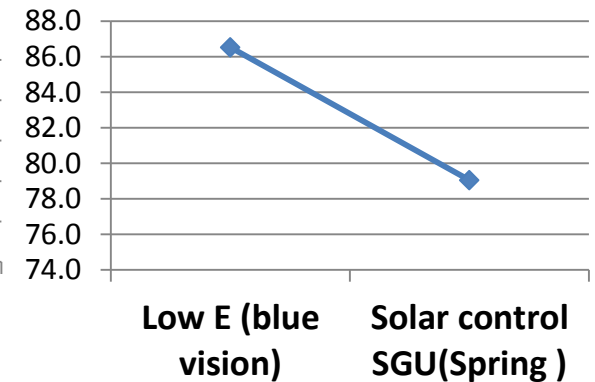


Type	Electricity consumption due to solar gains (KWH)	Electricity cost Annual (Rs)	Savings Annual (Rs)	Glazing Cost (Rs)	Extra payment for HP glass (Rs)	Payback years
Clear SGU	7924493	55471453		18000000		
Blue Vision	1068413	7478894	47992560	69000000	51000000	1.1
Spring SGU	1661261	11628826	43842627	33000000	15000000	0.3

cost of glazing



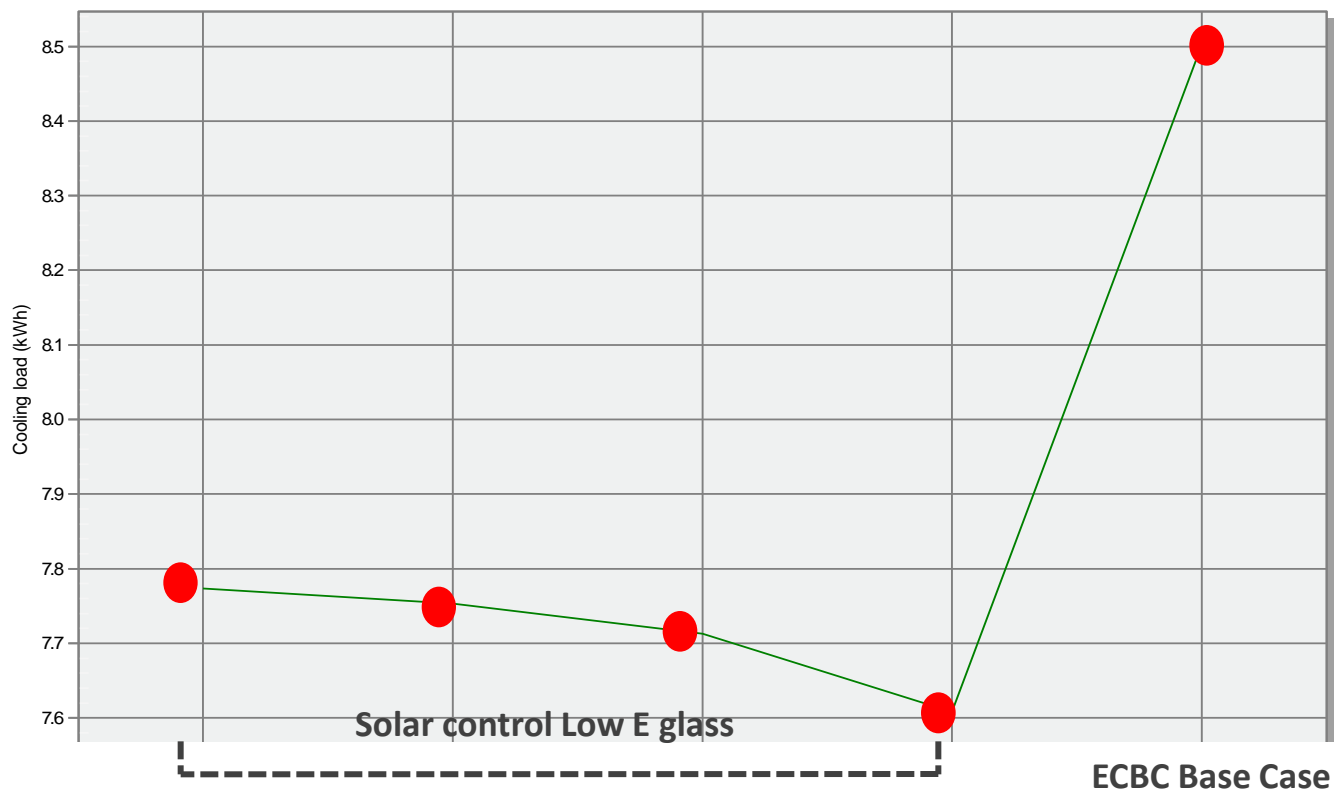
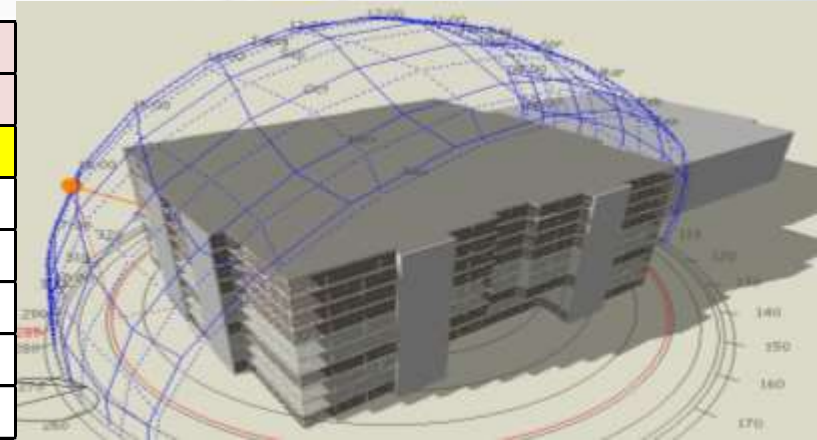
% of Energy Savings



Case 2 Commercial Building, Bangalore

WWR = 60%

Type	Electricity cost	Savings	money
	Annual (Rs)	Annual (Rs)	%saving
SGU			
Base case - ECBC	23091954.1		
Solar control Low E glass	18365575.2	4726378.9	20.5
	18229707.1	4862247.0	21.1
	17901711.5	5190242.6	22.5
	17345102.2	5746851.8	24.9



Using low E glazing reduces the cooling loads of the building and hence total Electricity consumption reduces by 20 - 25%.

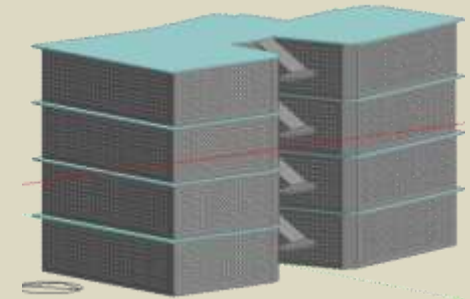
Innovative Techniques



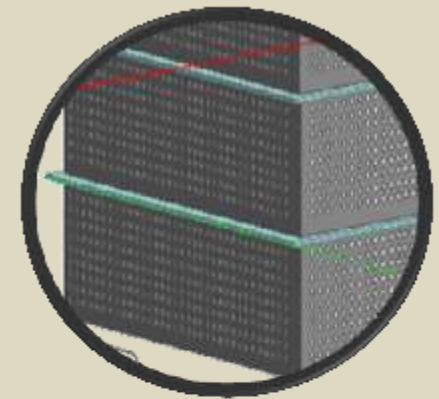
Case 1: Double skin facade

A school in Mumbai

Type	Total Electricity Consumption	Electricity Cost	Savings
	(Mwh)	Annual (in lakhs)	Annual (in thousands)
Non - ventilated cavity			
Base case - 12mm AIS Clear	871	52	
12mm Ecosense Spring	884	53	-78.88
12 mm Ecosense Dawn	876	52	-27.80
Ventilated cavity			
12mm Ecosense Dawn	718	43	921.07



Double skin facade – Combination of perforated aluminum sheet & glazing



The non-solar heat gets trapped between the perforated aluminium façade and inside skin when using a low-E glass.

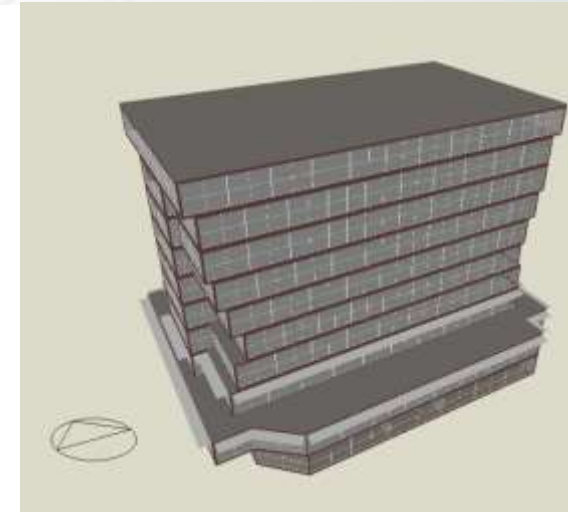
Non-solar heat gain is the reason for increase in heat gains.

Case 2: Inclined Facade



Daylight Analysis:

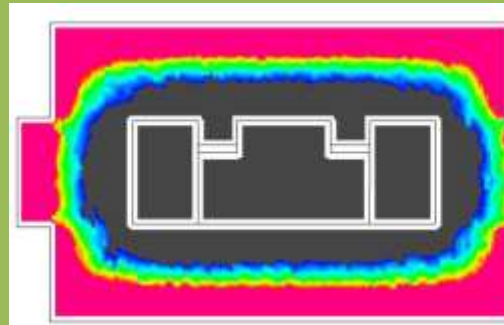
For a corporate building in Mumbai, daylight analysis was done for Clear Glass (VLT = 78%) and the high performance glass (VLT = 21%). Both the glasses performed identically in terms of achieving the optimal lux levels. Clear Glass, in fact, caused glare in certain portions of the building.



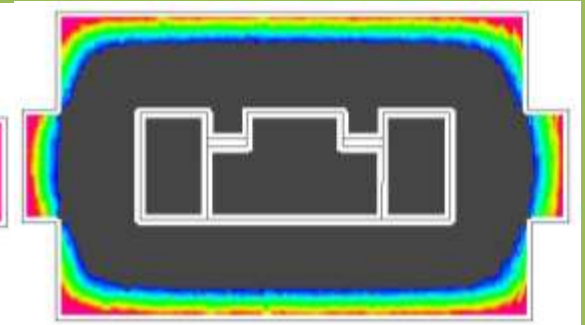
Pink region shows area which will have glare and Grey indicates sub-optimal lighting
In 2nd case, we can see reduction in glare area without reducing optimum lux level.



VLT 78%



VLT 21%



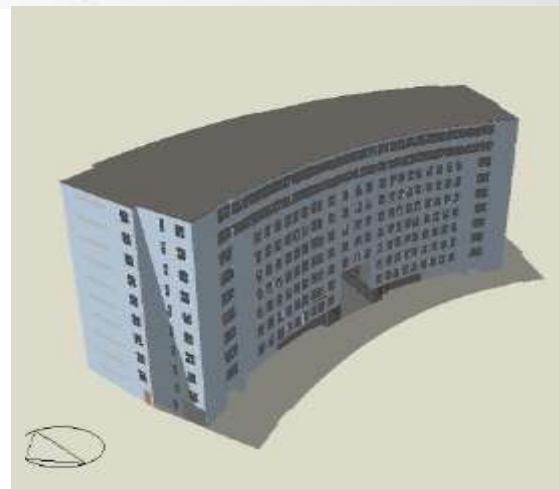
- Daylight analysis is important as it prevents overdesigning of the building and at the same time optimizes VLT requirement.
- In the case mentioned, we can use high performance glass which will reduce cooling load without compromising on lighting load

Case 3: Climate Analysis



Office Building in Bangalore

Climatic condition of the location is important to select type of glazing as different weather conditions have different impact on glass.



Calculations	Total (KWh)	Cost of Electricity	Savings (Kwh)/ Yr	Savings (Rs.) / Yr	Cost of Glass	Cooling design (Kwh)	Cooling Load In TR	Units	Cost	Saving	Extra Paid for Glass
base case clear Glass SGU	7032860	42197163			2750000	3052	862	300tr*3	21375000		
Enhance Pine SGU	7244067	43464400	-211206	-1267237	5500000	2960	836	300tr*3	21375000	0.00	2750000
Enhance Reef SGU	7034942	42209653	-2082	-12491	5500000	2905	820	300tr*3	21375000	0.00	2750000
Proposed Glass	7099559	40597354	-66699	-400191	5750000	2800	790	300tr*2 + 200tr*1	19000000	2375000	3000000
Proposed Glass with lighting controls	7320208	43921247	-287347	-1724085	5750000	2876	812	300tr*2 + 200tr*1	20187500	1187500	3000000
Proposed Glass without lighting controls	7640898	45845389	-608038	-3648227	4250000	2885	814	300tr*2 + 200tr*1	20187500	1187500	1500000

Glass with SF of 37 & U-Val – 5.7 was as efficient as a glass with SF of 25 & U-Val – 3.7. The building design & the local weather conditions meant that you can relax the glass values and still be energy efficient.

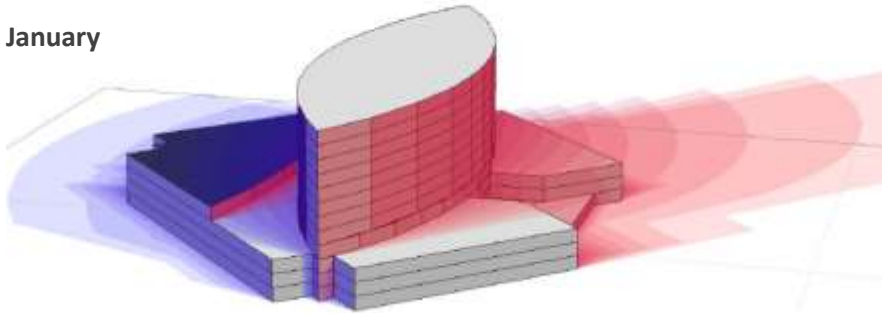
Case 4: Orientation



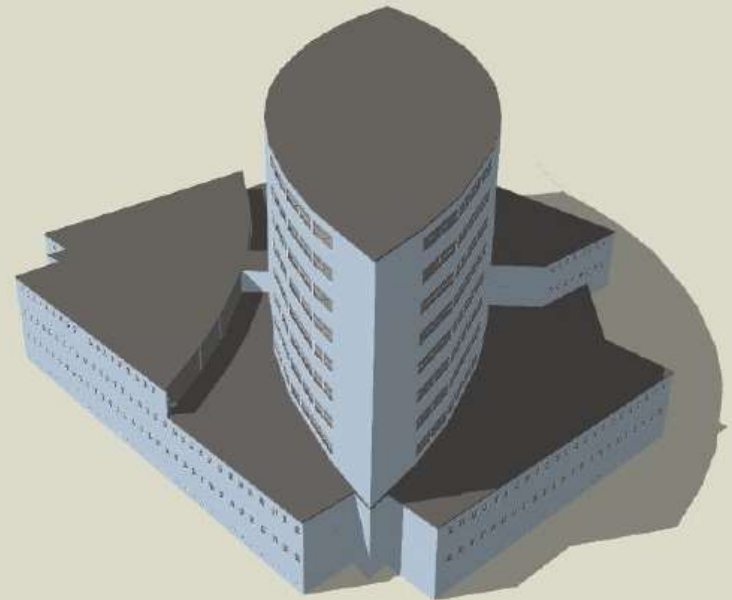
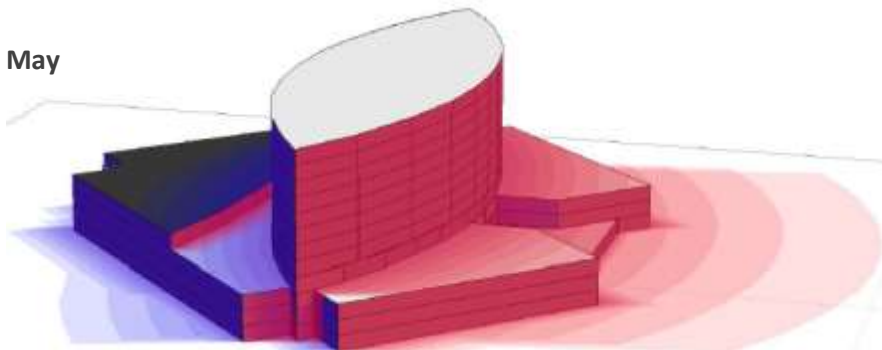
A commercial complex at Navi Mumbai with glazing on the Eastern and Southern façade showed that Clear Glass performed as good as “high-performing glasses” and the choice came down to aesthetics.

Shadow Analysis:

January



May

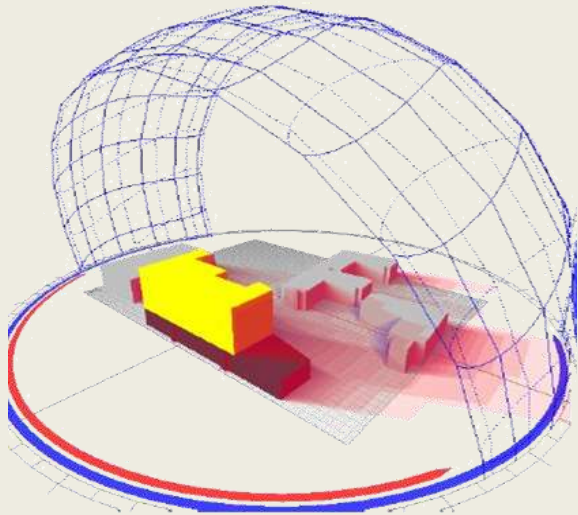


Right orientation reduces the demand for high performance parameters.

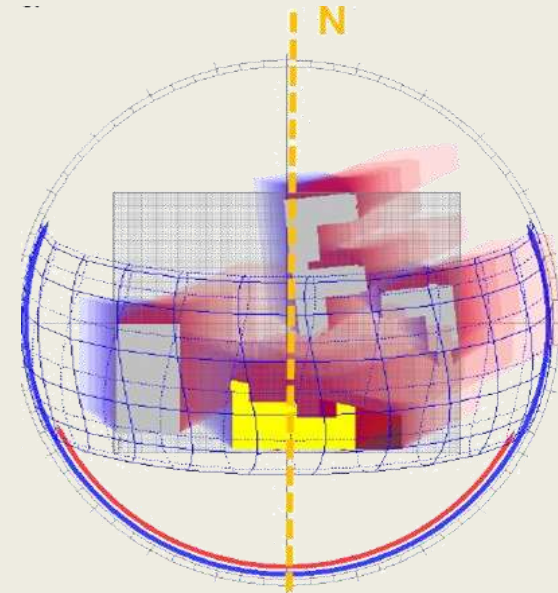
Shadow Analysis:

Blue indicates the sun's path in summer and Red indicates the sun's path in winter.

Perspective View



Plan



Shadow Analysis suggests the optimum requirement of Glazing performance parameter to be used.

Things to Note



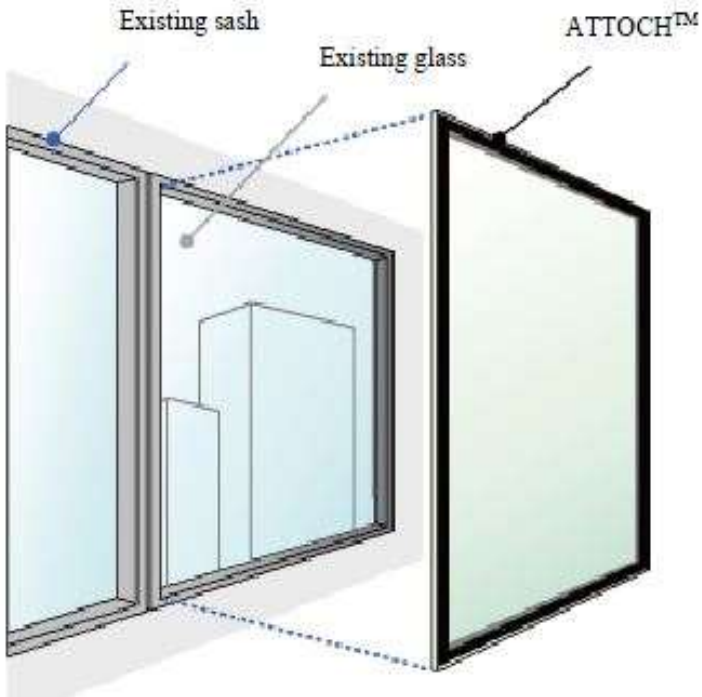
- The same fenestration behaves differently depending on the specific design.
- It should not be assumed that products with Low U-value and SHGC are the best and universal solution.
- Direct radiation falling on the windows should be minimized.
- For shaded windows, products with lower U-values perform better.
- For windows receiving high amount of solar radiation, products with low SHGC would perform better.
- Hence glazing should be selected after thoroughly considering the design.



Trends in Glass

1) Façade Retrofitting for better energy performance:

“ATTOCH” an Ecoglass product that is ideal for energy-saving window renovations



How is it installed?

This product converts an existing windowpane into Ecoglass simply by applying Low-E glass to the inside of the window.

Facts and Figures :

- Installation takes only 30 to 60 minutes per window.
- The existing glass continues to be used, and so does not require disposal.



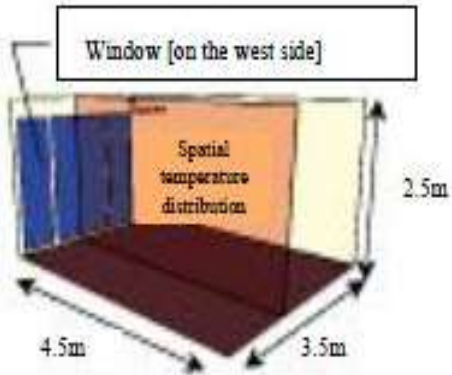
Before installation



After installation

Energy Savings :

Outline of thermal environment calculation model



Before installation

After installation

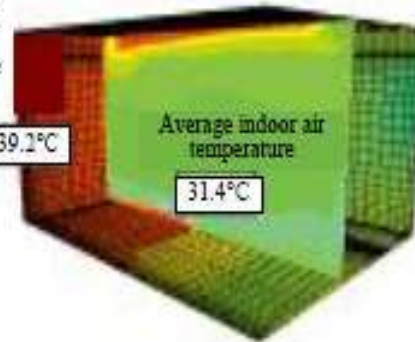
Summer

Average temperature of indoor glass surface

39.2°C

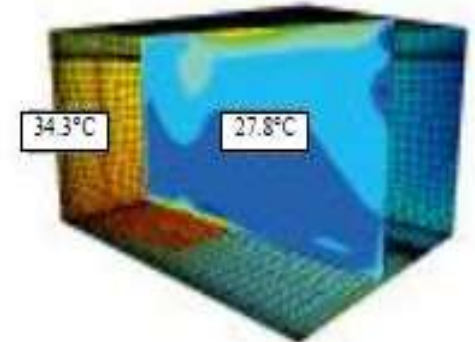
Average indoor air temperature

31.4°C



34.3°C

27.8°C



Winter

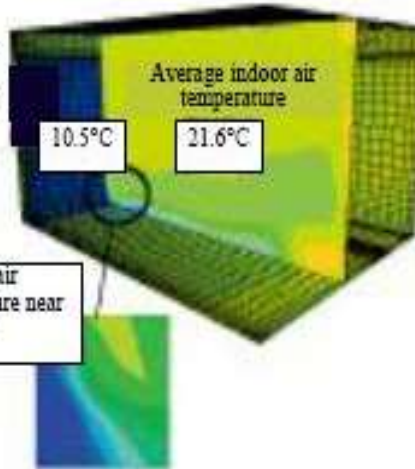
Average temperature of indoor glass surface

10.5°C

Average indoor air temperature

21.6°C

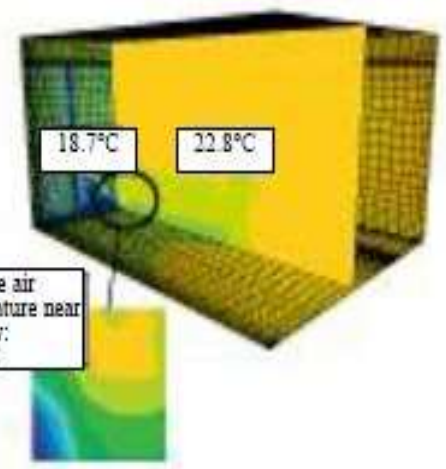
Average air temperature near window: 16.8 °C



18.7°C

22.8°C

Average air temperature near window: 20.8 °C

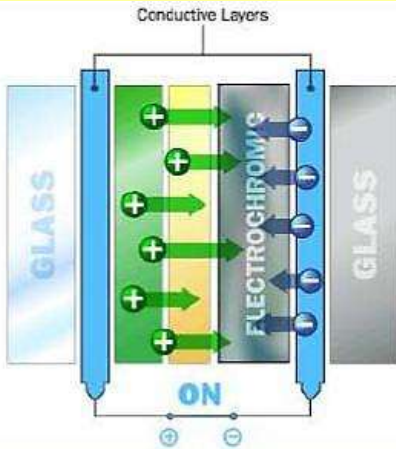


This Innovative technique of Retrofitting helps to reduce air-conditioning energy use by about 30% a year

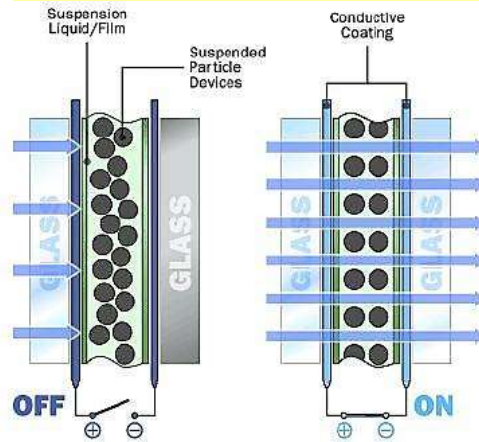
2) Smart Glazing:

Smart glazing refers to electrically switchable glass or glazing which changes light transmission properties when voltage is applied.

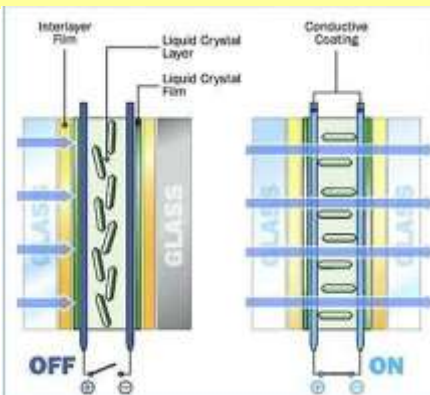
1) Electro-chromic glass



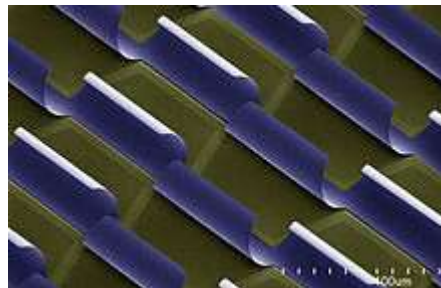
2) Suspended particle device



3) Liquid crystal device



4) Micro Blinds



Application :

- Windows
- Doors
- Sunroofs



Benefits :

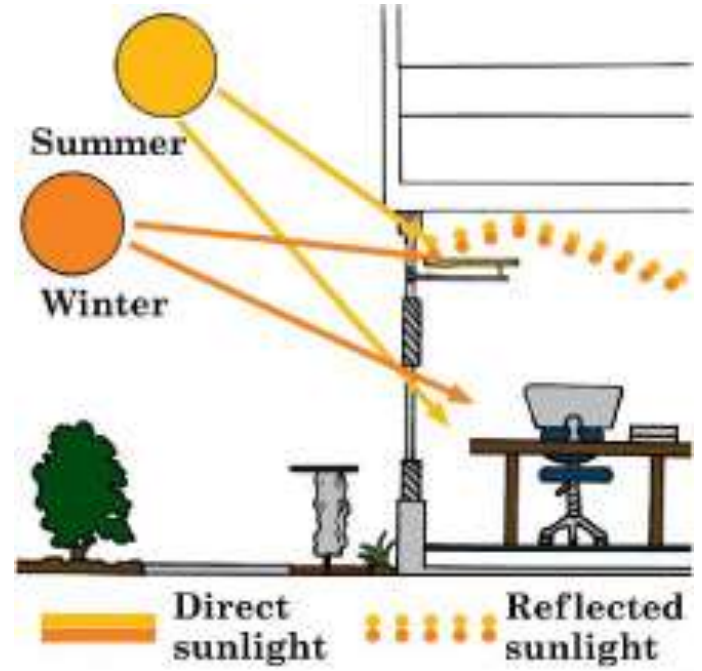
- Energy Efficiency
- Occupant wellbeing
- Security

3) Building Integrated Photo Voltaic



solar panels that follow the sun at the same time shading the inside of the building to reduce air conditioning.

4) Light Shelves:



5) Glass as structural material:



Conclusion



"That's one small step for (a) man, one giant leap for mankind."

- *Neil Armstrong*





Thank you
for your time