Technology and Techniques

in glass facades

SEE MORE

Building follows Trend :

Conventional Green Buildings:

E.P.I = 140 kWh/m²-yr

Cost / m² =Rs.1100 /-

Modern Buildings : Air Conditioned

E.P.I = 200 kWh/m²-yr

Cost / m² =Rs.1600 /-

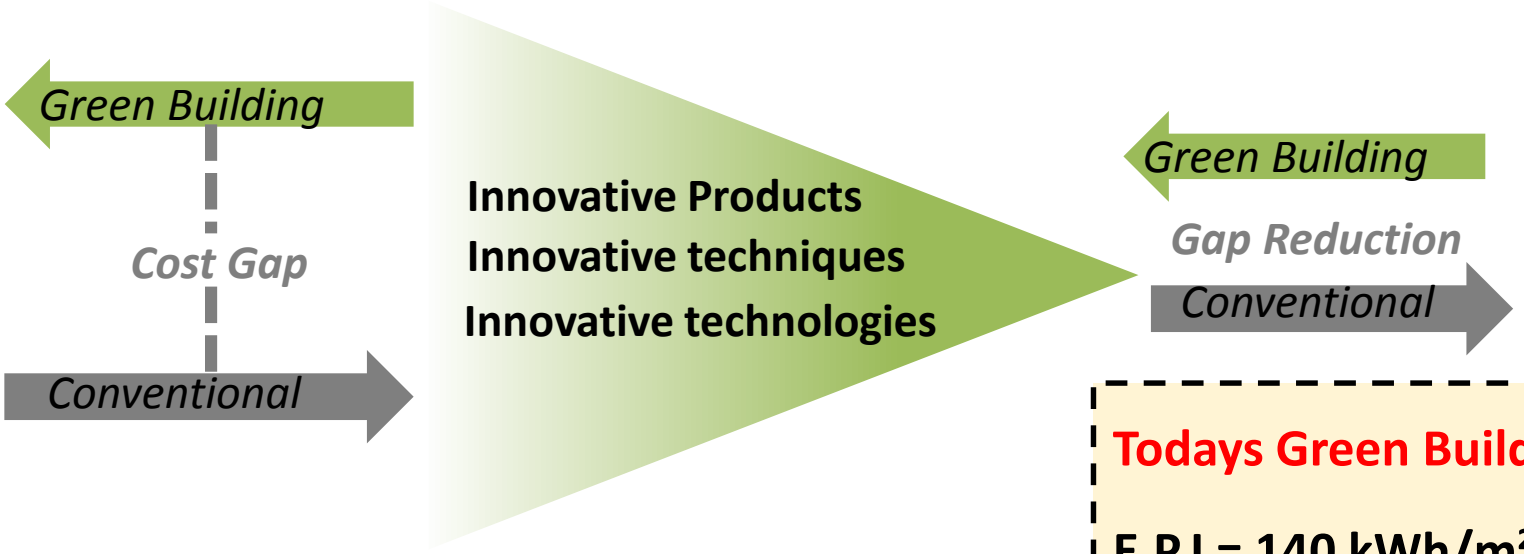
Vernacular Buildings : Non Air conditioned

E.P.I = 45 kWh/m²-yr

Cost / m² = Rs.400/-

Issues related to conventional green buildings:

- The mind set of people focuses towards gaining a status symbol rather than gaining economical and environmental benefits.
- Additional cost of Construction and Installation.
- Additional cost for maintenance.
- Gap between cost of conventional building and green building is huge.



Todays Green Buildings :

E.P.I = 140 kWh/m²-yr

Cost / m² =Rs.1100/-

Changing Façade Trends

Commercial	Residential	Institutional	Amenities
			
30% – 75%	25% – 40%	30% – 70%	35% – 60%
			

With changing Architectural trends the WWR is continuously increasing .
And this is why glazed facades become a major source of solar heat gain.

Role Of Glass In Buildings

How Glass is a Sustainable product?

- Recyclable
- Use Renewable resources
- Locally or Regionally produced
- Energy Efficient
- Low embodied energy
- Low Environmental Impact
- Durable
- Minimize Waste
- Positive Social Impact
- Affordable

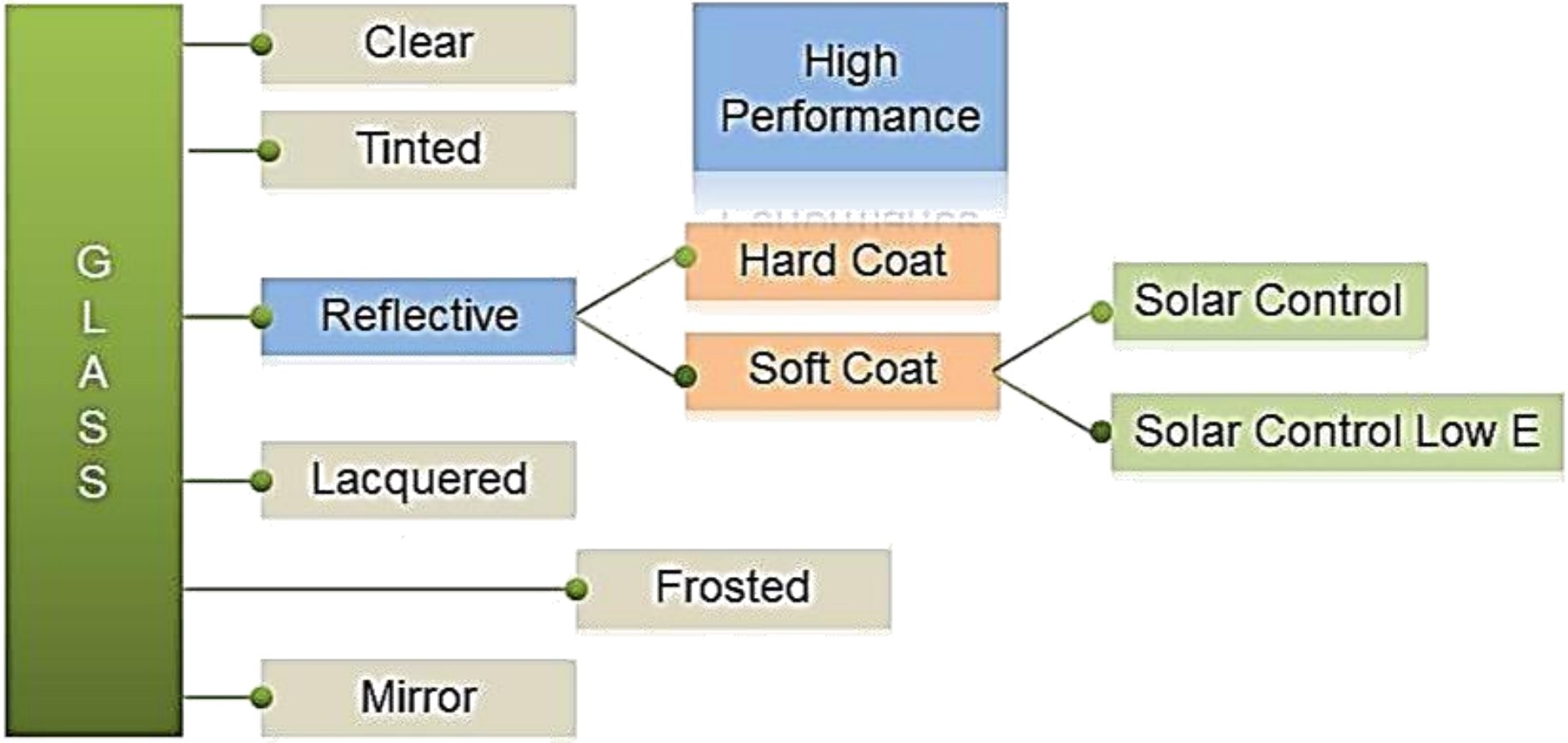
How Glass contributes ?

- Daylighting
- Participation with the outside world
- Recyclability
- Very High levels of energy efficiency
- Sound control & fire proofing
- Local & Regional material
- Innovation in design, intent & purpose
- Manifesting Architects' design desire

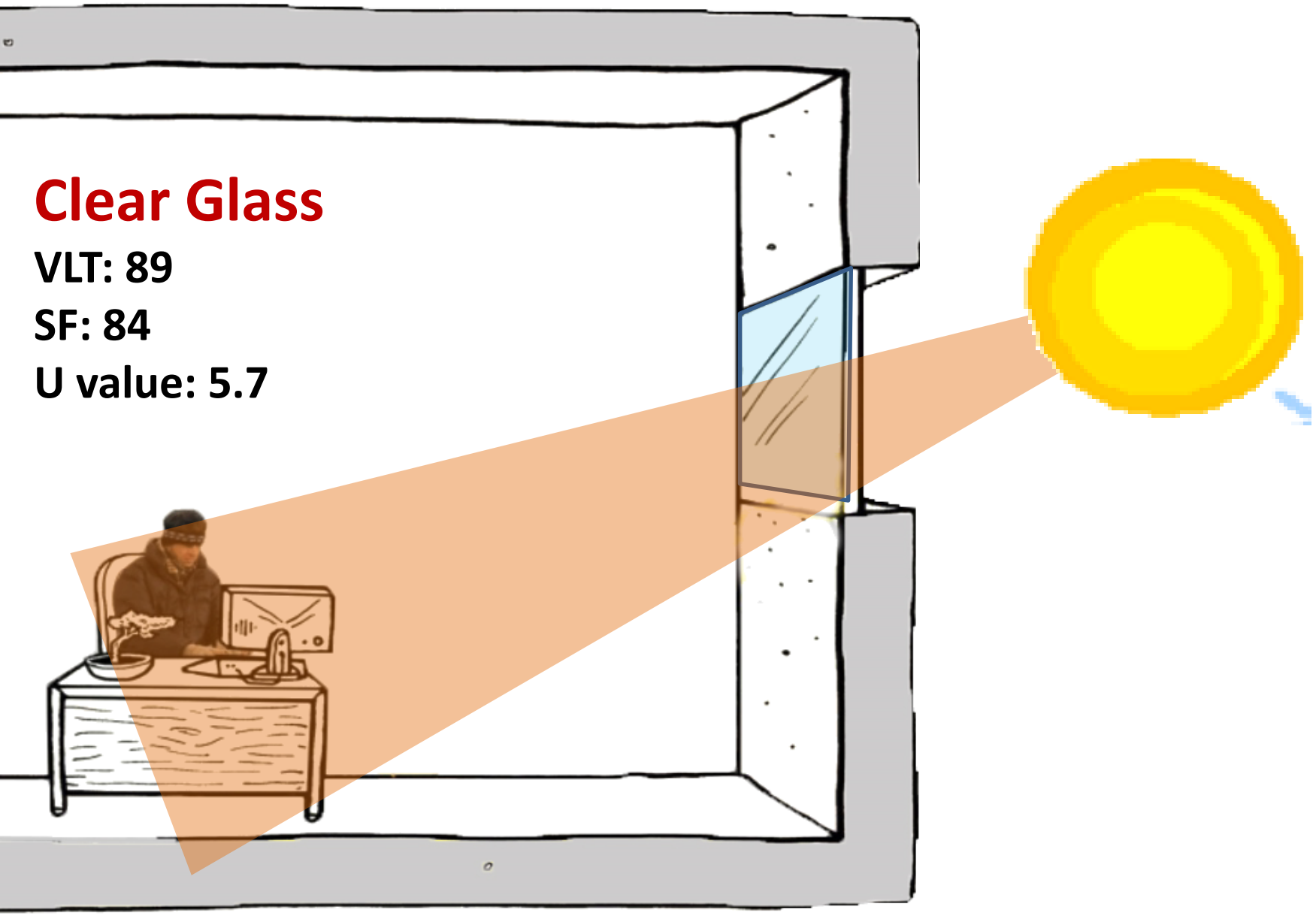
Glazing in today's buildings:

- **Innovative Products**

A single element added to glass can significantly **change** its **properties.**



Performance Parameters:



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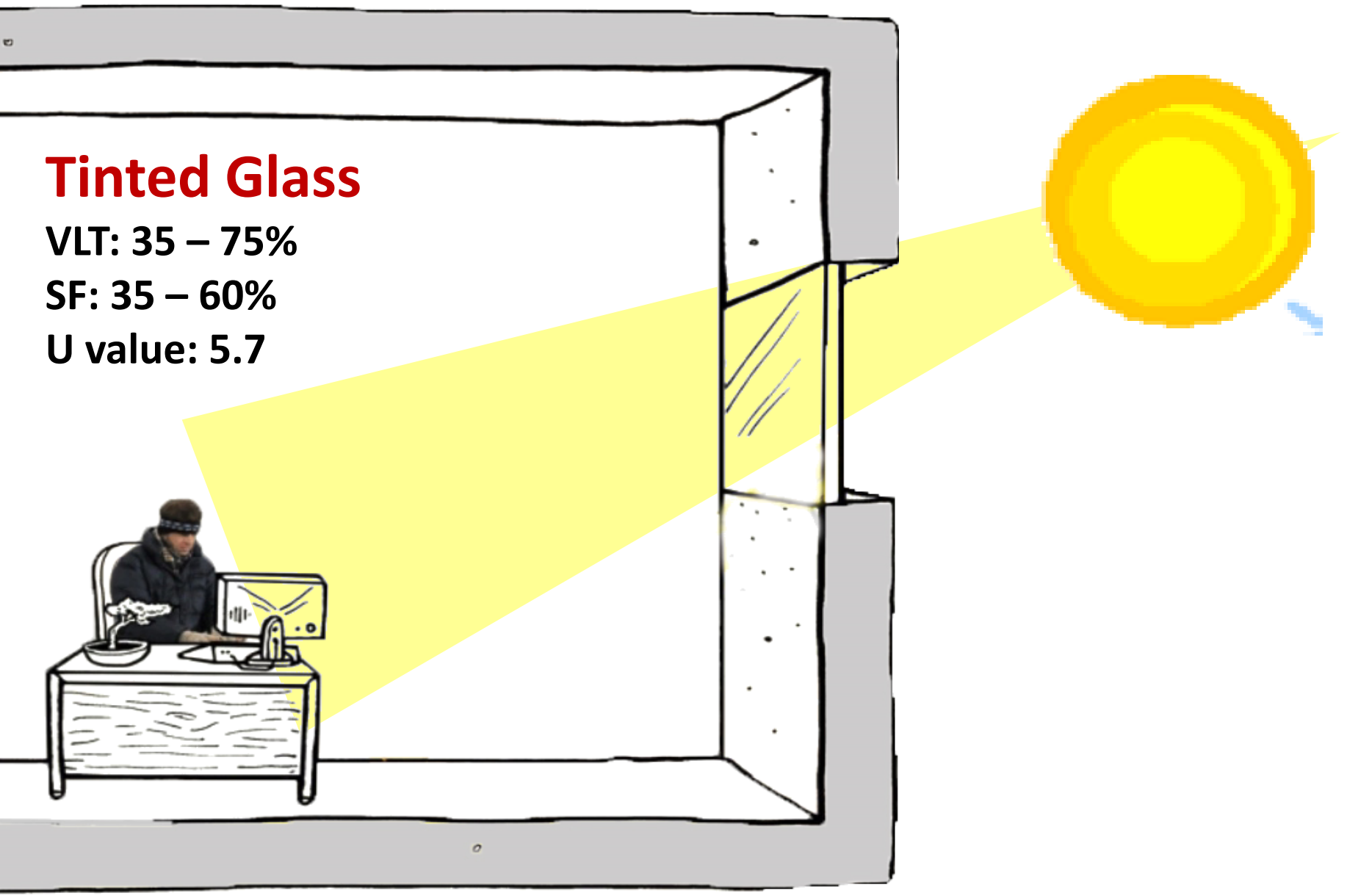

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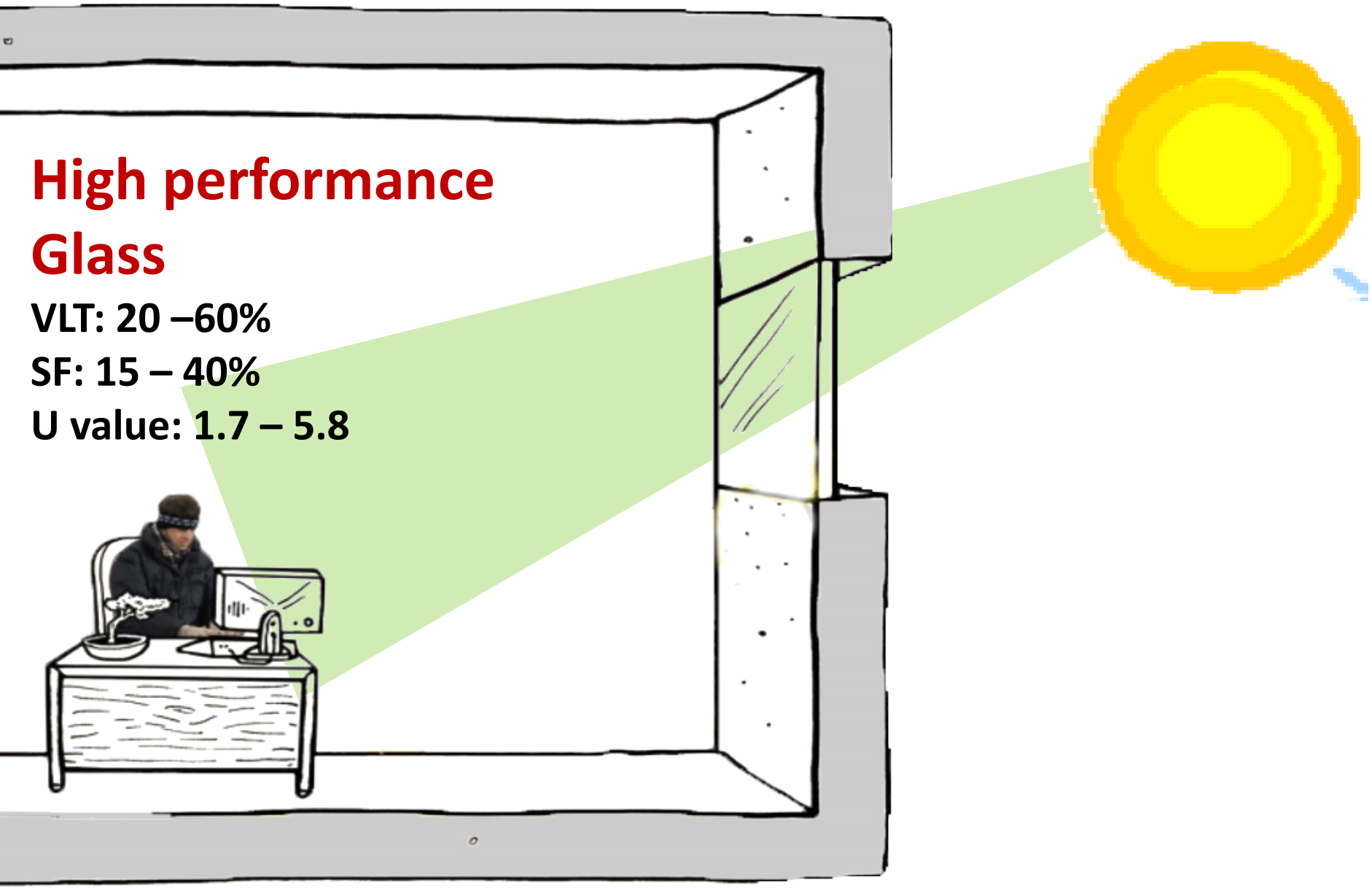
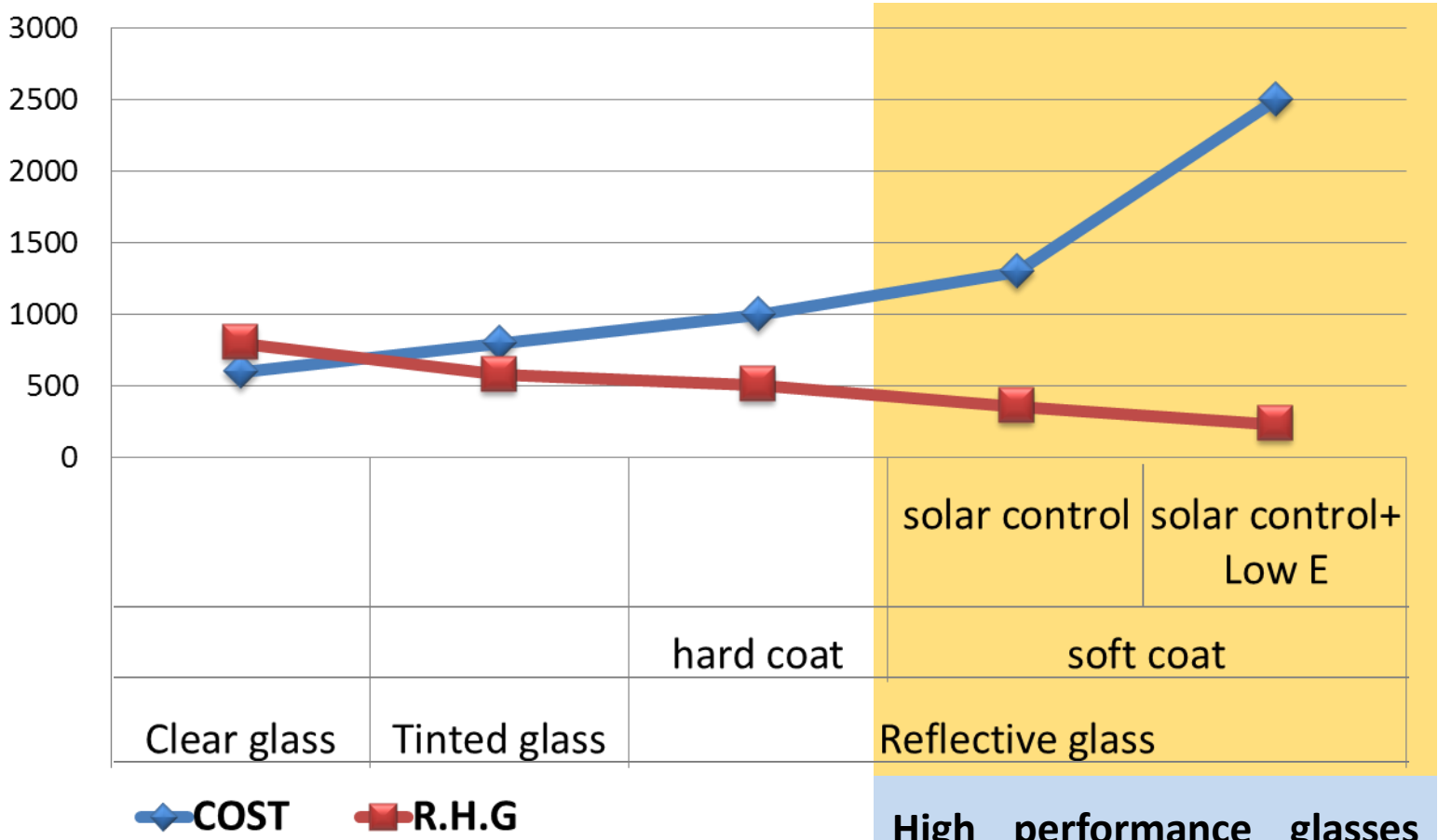


Glazing Cost and Performance :

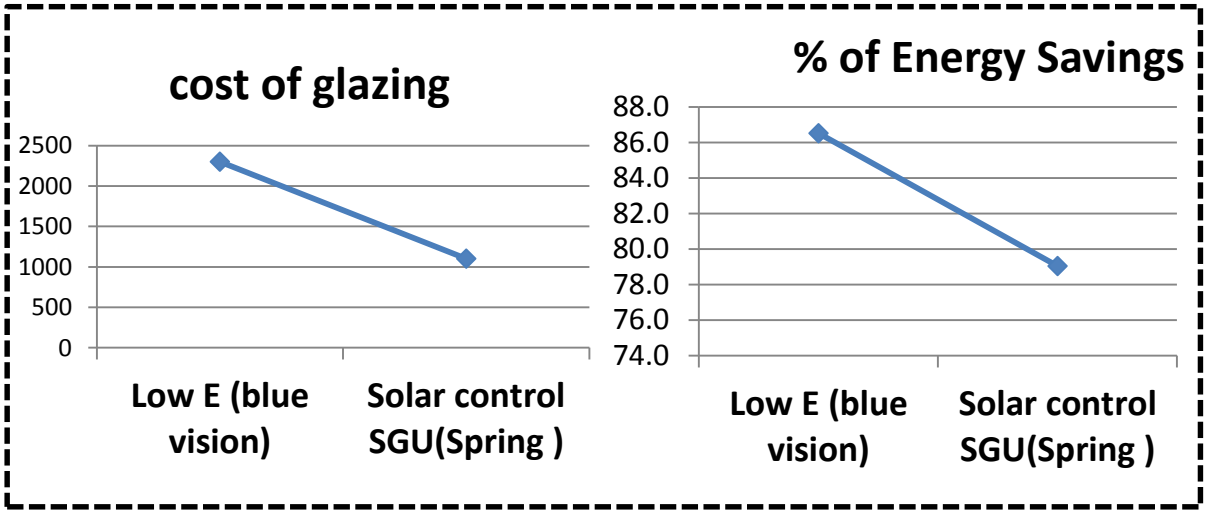


High performance glasses are innovative products which are expensive but cost beneficial as the amount of heat gain is less and hence more energy saving.

How expensive Glazing is cost beneficial?

Case1 Office building, Noida WWR > 60%

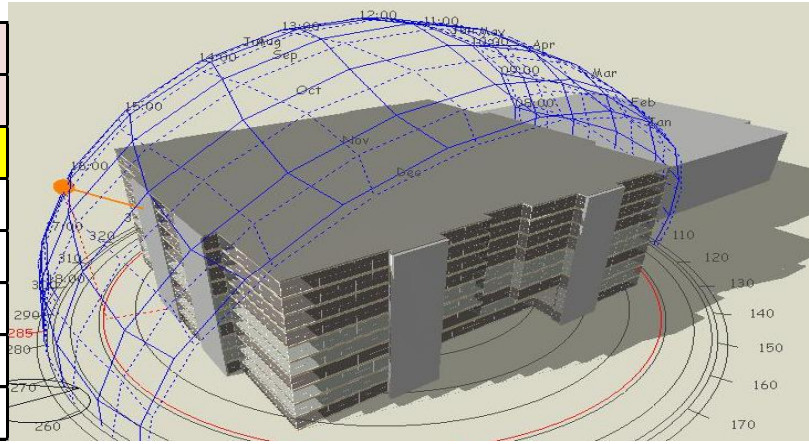
Type	Electricity consumption due to solar gains	Electricity cost	Savings	Glazing Cost	Extra payment for HP glass	Payback
	(KWH)	Annual (Rs)	Annual (Rs)	(Rs)	(Rs)	years
Clear SGU	7924493	55471453		18000000		
Blue Low-e	1068413	7478894	47992560	69000000	51000000	1.1
Solar Control SGU	1661261	11628826	43842627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

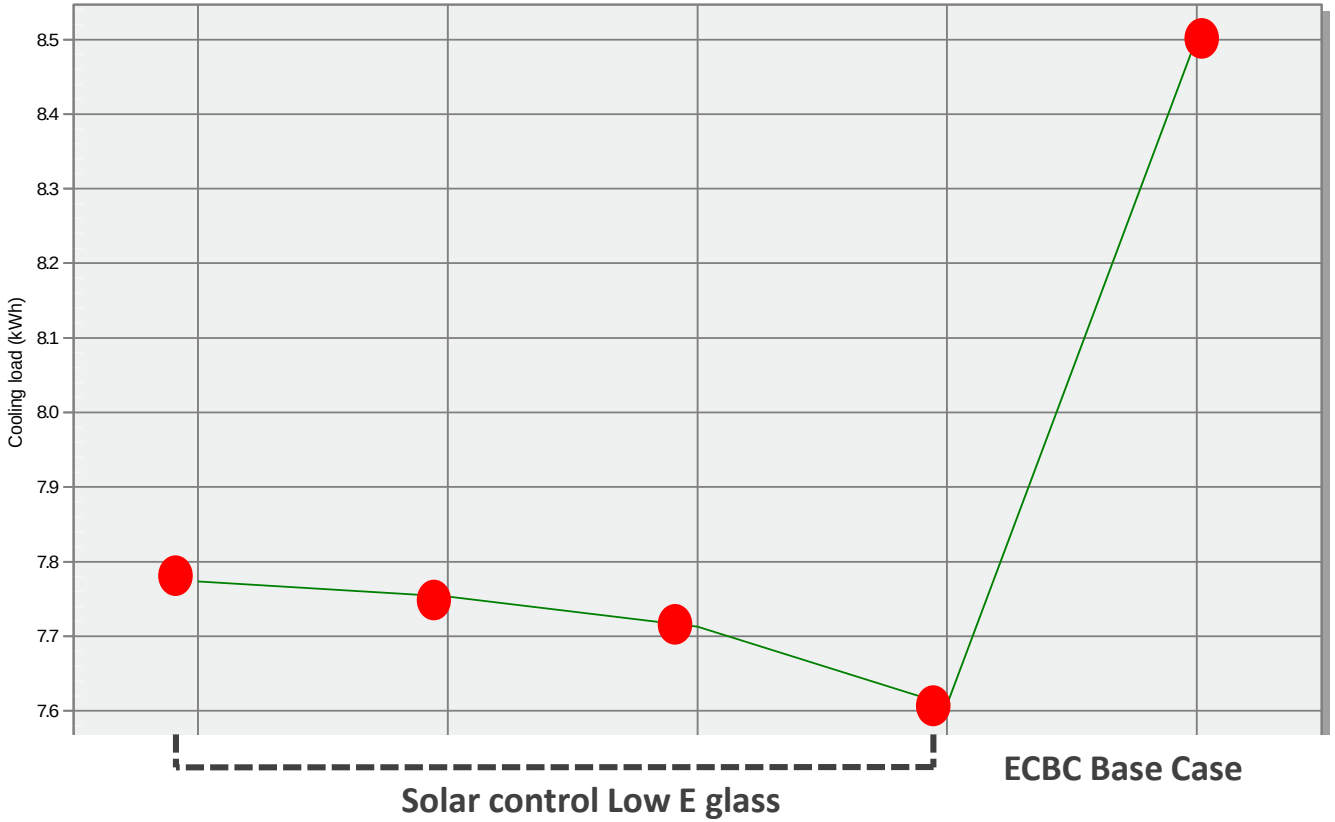


Electricity consumption reduces by 85 %, if solar control low E glasses are used with payback period of 1 year.

Case 2 Commercial Building, Bangalore WWR = 60%

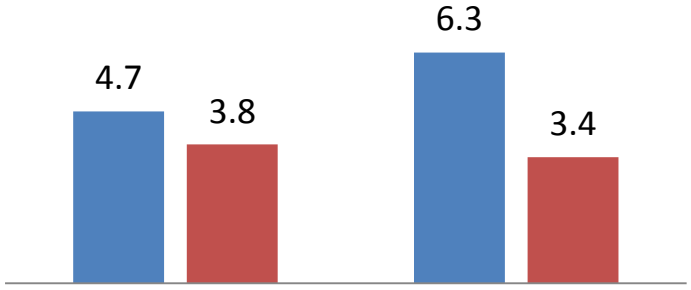
Type	Electricity cost	Savings	money
	Annual (Rs)	Annual (Rs)	%saving
SGU			
Base case - ECBC	23091954.1		
Solar control Low E glass	18365575.2	4726378.9	20.5
	18229707.1	4862247.0	21.1
	17901711.5	5190242.6	22.5
	17345102.2	5746851.8	24.9

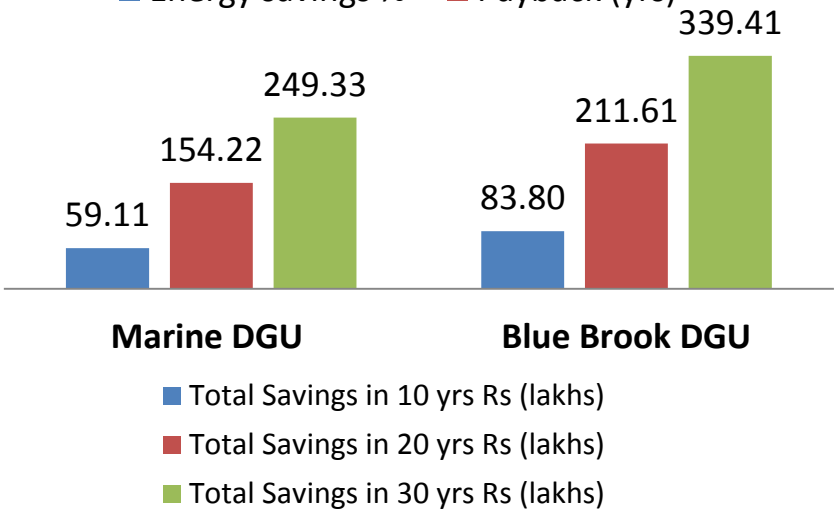


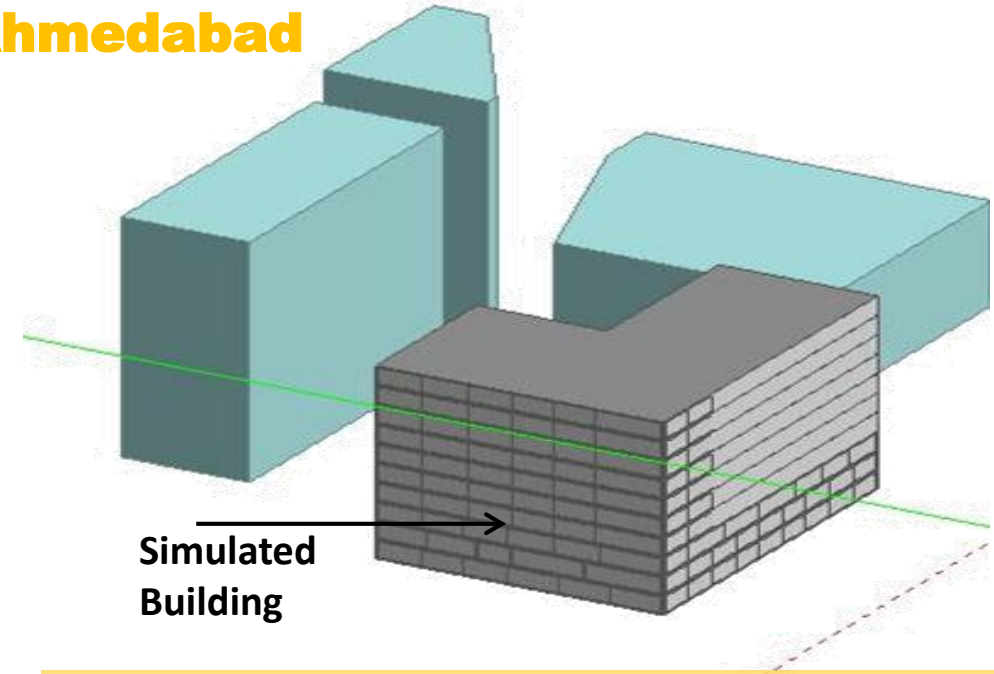


Using low E glazing reduces the cooling loads of the building and hence total Electricity consumption reduces by 20 - 25%.

Case 3 Hotel Building, Ahmedabad WWR = 70%







In this case the capital investment amount was huge and instant savings were not given importance. Individual product paybacks were ignored and savings over the lifetime period of the building was the driving factor for decision making

Type	Total Electricity consumption	Electricity cost	Savings	Glazing Cost	Extra payment for HP glass	Payback	EPI
	(kWH)	Annual (Rs)	Annual (Rs)	Rs	Rs	years	KWhr/sqm
Base case clear DGU	3382464	20294783		4800000			145.6
Solar Control Blue DGU	3223950	19343699	951084	8400000	3600000	3.8	131.5
Blue Low-e DGU	3169456	19016736	1278047	9200000	4400000	3.4	126.9

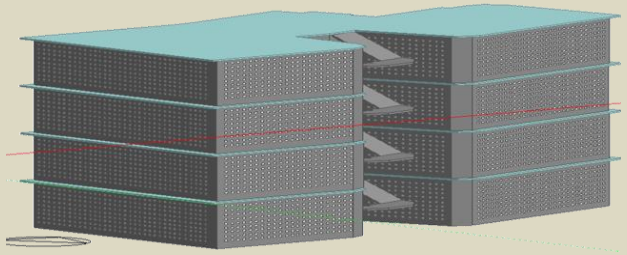
Innovative Techniques

Technology and Techniques go hand in hand.

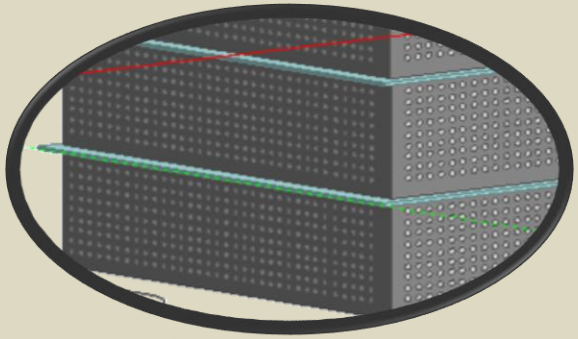
Developing new products and technologies alone cannot solve all the issues, their installation techniques and applications are equally important.

Case 1 Double Skin Façade School, Mumbai

Type	Total Electricity Consumption (Mwh)	Electricity Cost Annual (in lakhs)	Savings Annual (in thousands)
Non - ventilated cavity			
Base case - 12mm AIS Clear	871	52	
12mm Clear SC	884	53	-78.88
12 mm Clear SC	876	52	-27.80
SC (Clear SC)	876	52	-27.80
SC + LE)	876	52	-27.80
Ventilated cavity			
12mm Clear SC	718	43	921.07
Clear SC DGU	718	43	921.07
Clear Low-e DGU	718	43	921.07



Double skin facade – Combination of perforated aluminum sheet & glazing

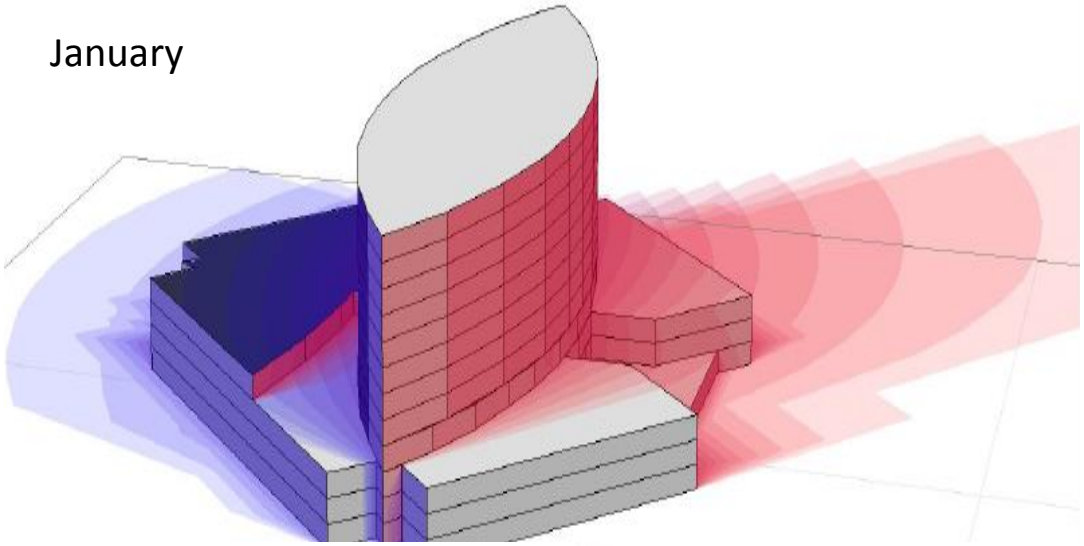


The non-solar heat gets trapped between the perforated aluminium façade and inside skin when using a low-E glass.

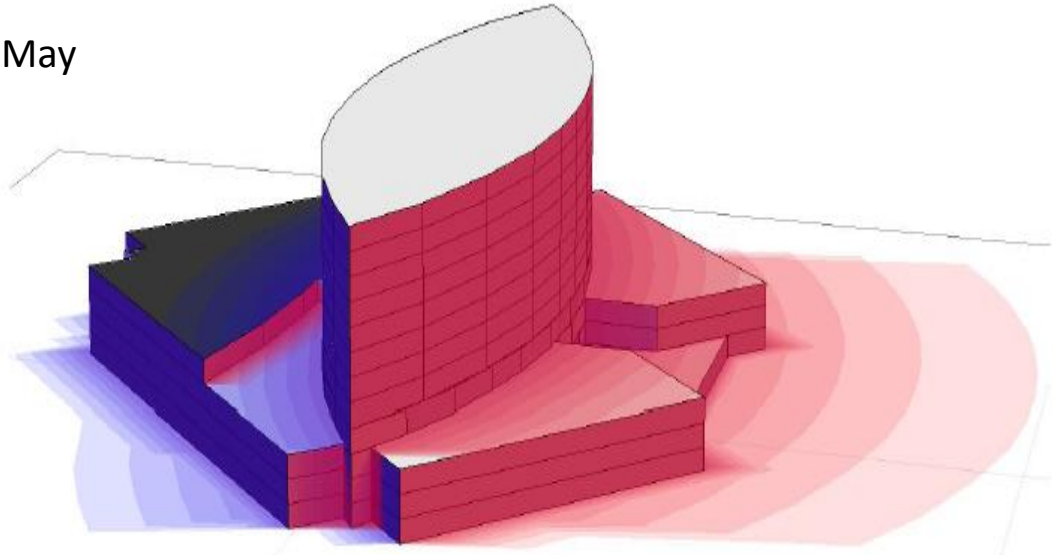
Non-solar heat gain is the reason for increase in heat gains.

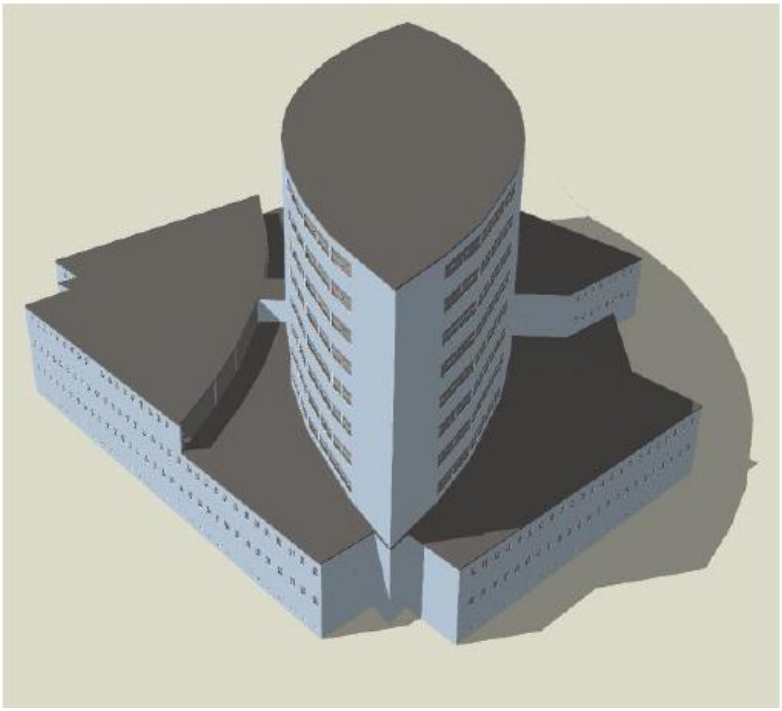
Case 2 Optimum Orientation Commercial, Navi Mumbai

January



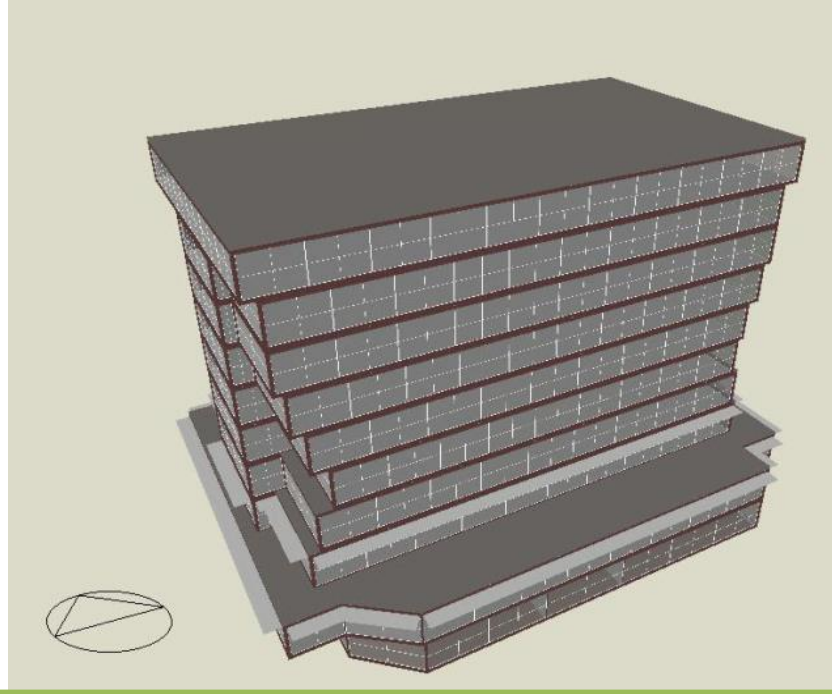
May





Glazing on East & South Façade showed that **Clear Glass performed as good as the so called "high – performance glasses"** and the choice came down to aesthetics

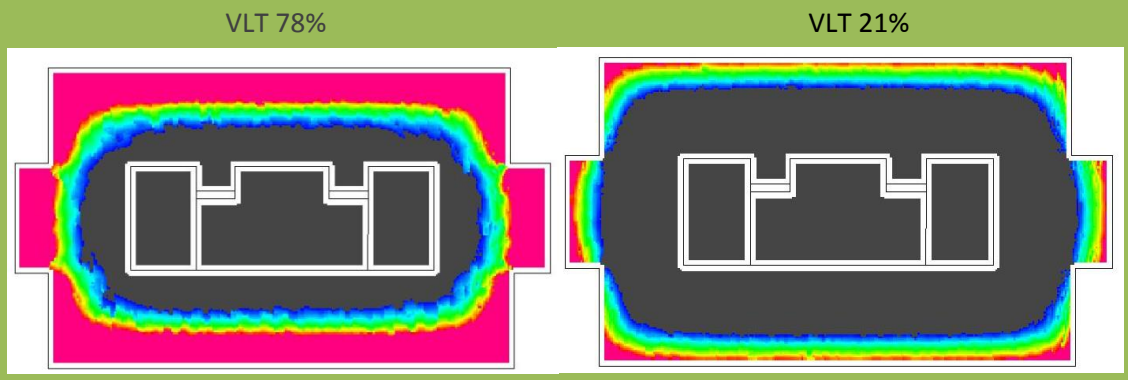
Case 3 Inclined Facades Office , Mumbai



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.



- 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 4

Climate Analysis
Office , Bangalore

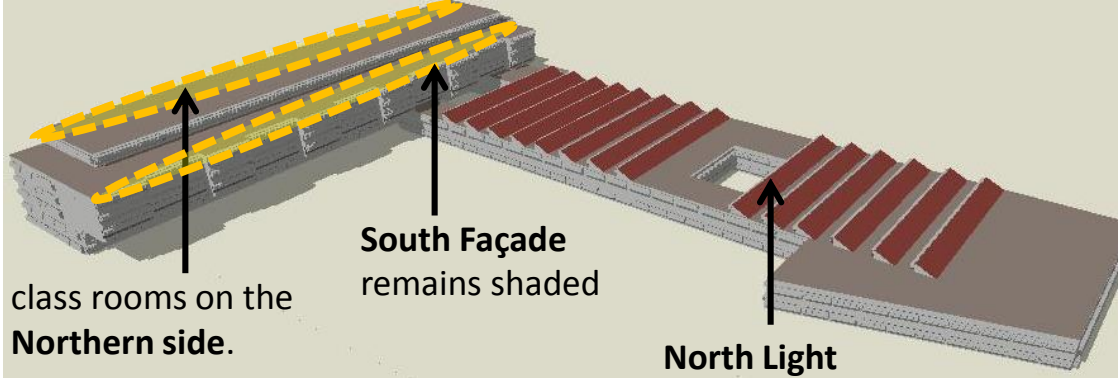
Climatic condition of the location is important to select type of glazing as different weather conditions have different impact on glass.

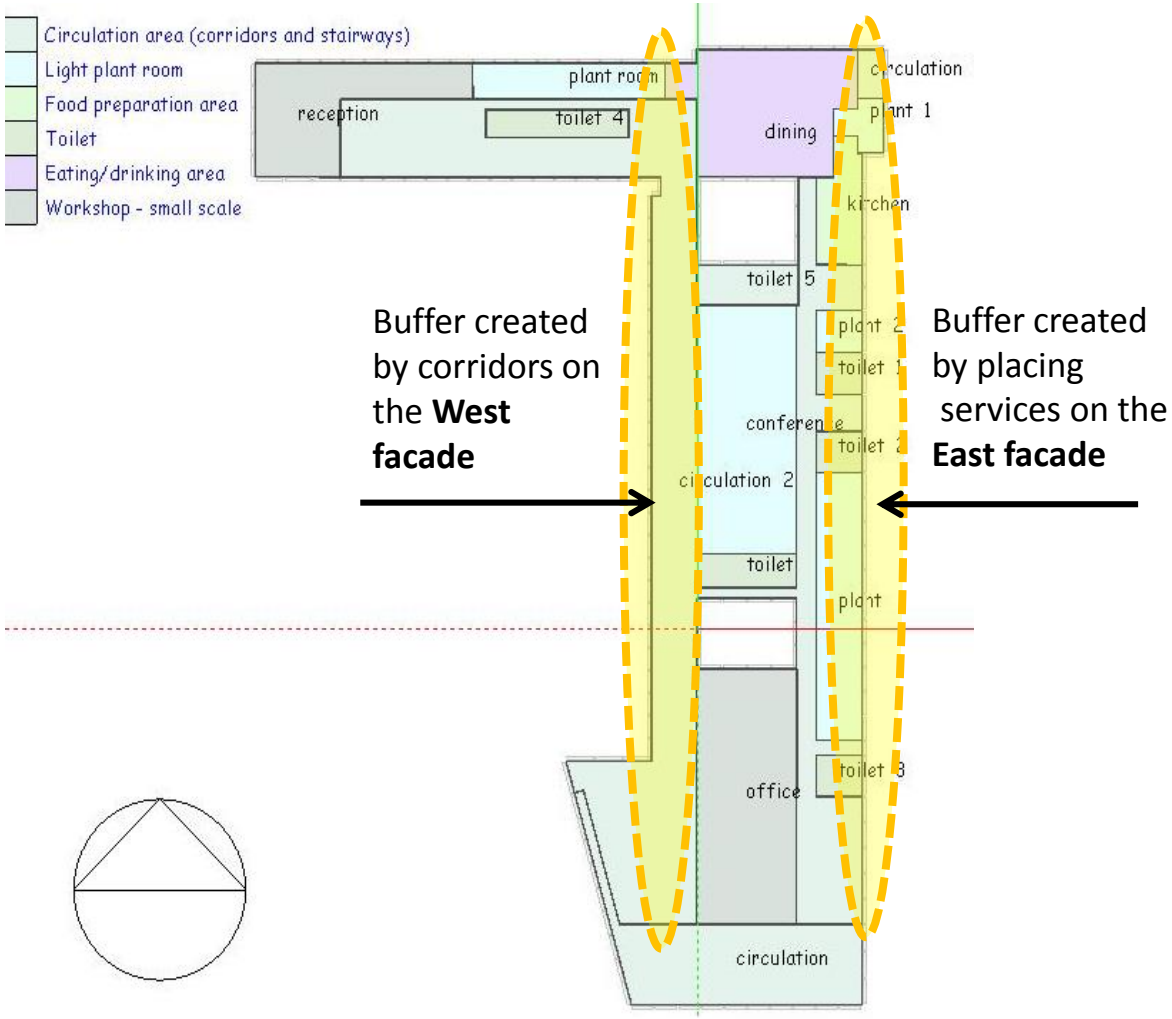
Calculations	Total (KWh)	Cost of Electricity	Savings (Kwh)/ Yr	Savings (Rs.) / Yr	Cost of Glass	Cooling design (Kwh)	Cooling Load In TR	Units	Cost (Cr.)	Saving	Extra Paid for Glass
base case clear Glass SGU	7032860	4.21			2750000	3052	862	300tr*3	2.13		
SC Green SGU	7244067	4.34	-211206	-1267237	5500000	2960	836	300tr*3	2.13	0.00	2750000
SC Green SGU	7034942	4.22	-2082	-12491	5500000	2905	820	300tr*3	2.13	0.00	2750000
Proposed Glass	7099559	4.05	-66699	-400191	5750000	2800	790	300tr*2 + 200tr*1	1.90	0.23	3000000
Proposed Glass with lighting controls	7320208	4.39	-287347	-1724085	5750000	2876	812	300tr*2 + 200tr*1	2.01	0.118	3000000
Proposed Glass without lighting controls	7640898	4.58	-608038	-3648227	4250000	2885	814	300tr*2 + 200tr*1	2.01	0.118	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 5

Optimum Design
Learning center , Mumbai

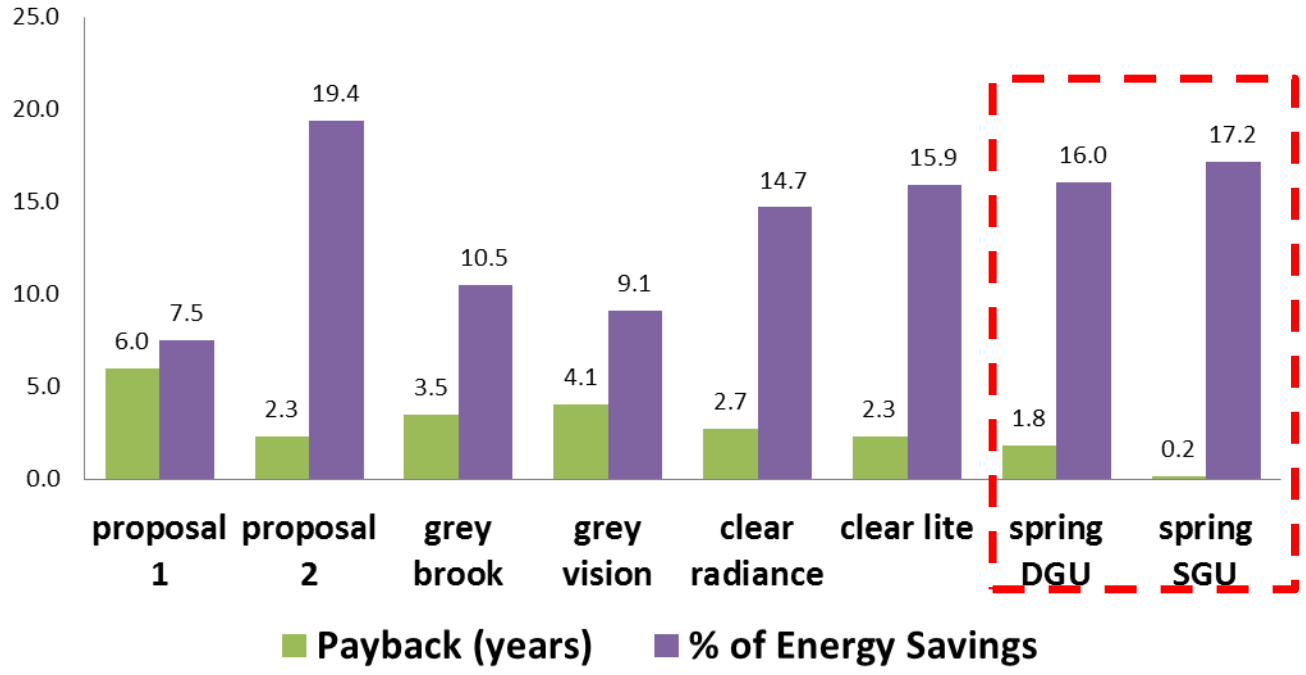




DESIGN FEATURES :

- Learning centre is optimally designed with louvers on all the glazed facades.
- North light on the roof for capturing daylight.
- The East and West radiations are blocked by creating buffer spaces of service areas and corridors

Type	Total Energy consumption (KWH)	Electricity cost Annual (Rs)	Savings Annual (Rs)	Glazing Cost (Rs)	Extra payment for HP glass (Rs)	Payback years	Payback months
clear DGU (base case)	2745020	19215143		6120000			
proposal 1	2538093	17766650	1448493	14790000	8670000	6.0	71.8
proposal 2	2213137	15491961	3723182	14790000	8670000	2.3	27.9
grey brook	2455826	17190783	2024360	13260000	7140000	3.5	42.3
grey vision	2494779	17463453	1751690	13260000	7140000	4.1	48.9
clear radiance	2371756	16602292	2612850	13260000	7140000	2.7	32.8
clear lite	2307295	16151066	3064077	13260000	7140000	2.3	28.0
spring DGU	2304675	16132726	3082417	11730000	5610000	1.8	21.8
spring SGU	2274204	15919425	3295718	6630000	510000	0.2	1.9



Glass with SF of 64 ,VLT of 65 & U-Val – 5.7 was as efficient as a glass with SF of 35 , VLT of 72 & U-Val – 1.56. The building design , orientation and shading strategy meant that you can relax the glass values and still be energy efficient.

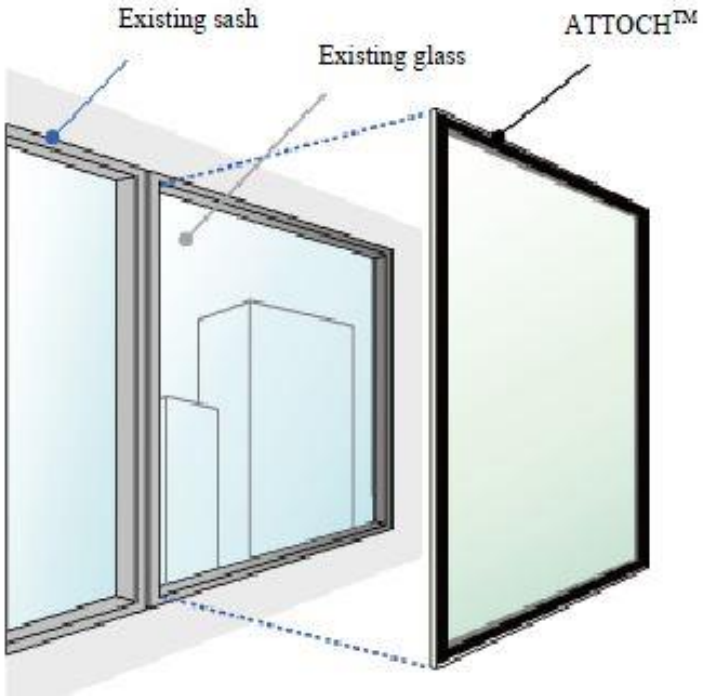
Learning :

- ✓ 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.
- ✓ 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.

Current 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.

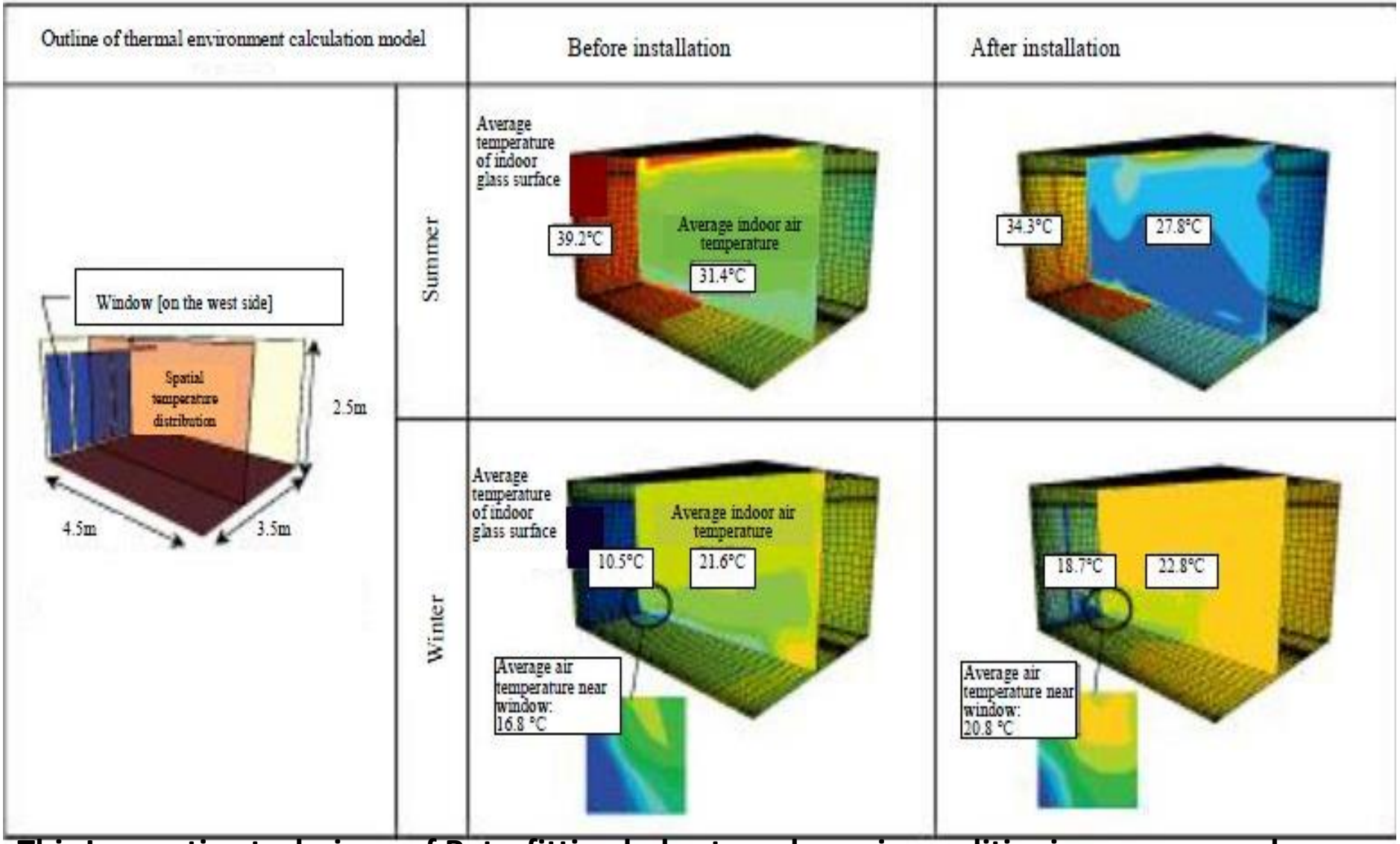
Before installation

After installation

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.

Energy Savings :

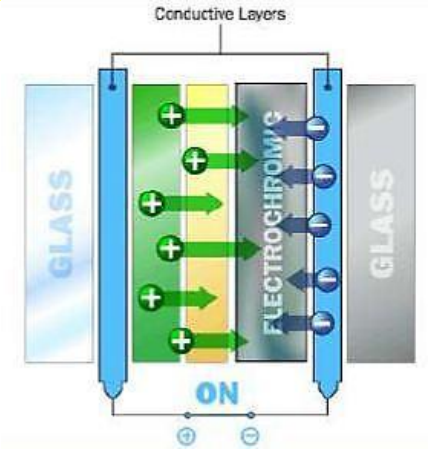


This Innovative technique of Retrofitting helps to reduce air-conditioning energy use by about 30% a year

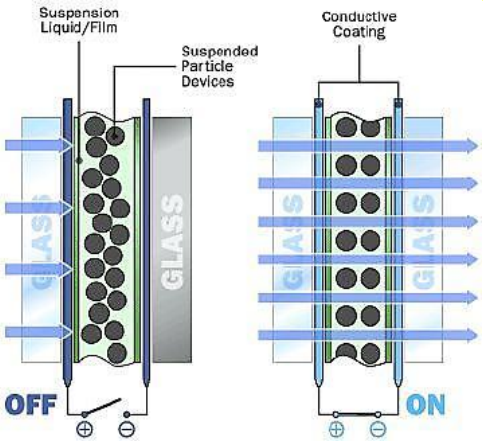
2) Smart Glazing:

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

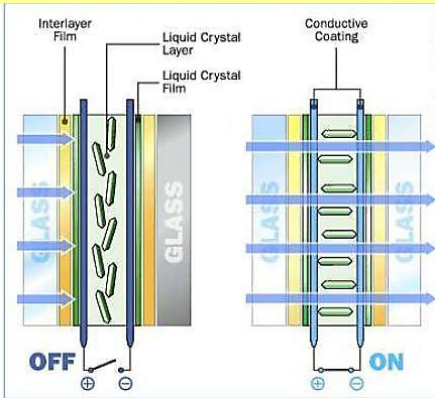
1) Electro-chromic glass



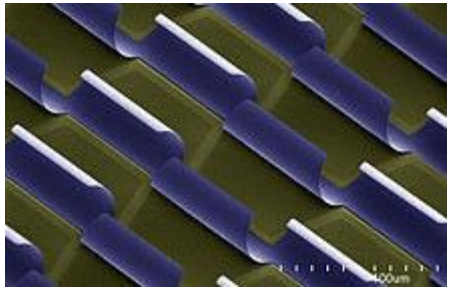
2) Suspended particle device



3) Liquid crystal device



4) Micro Blinds



Application :

- Windows
- Doors
- Sunroofs

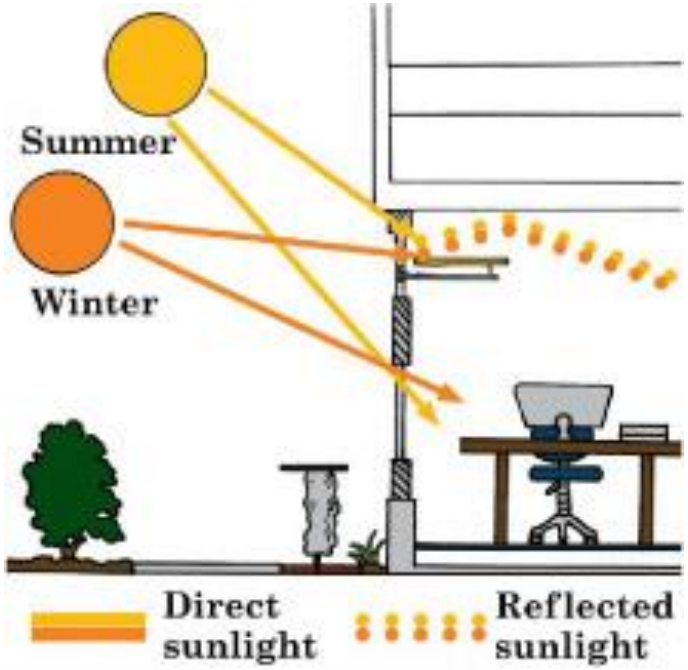
Benefits :

- 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:

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GRIHA Trainer

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