Energy Efficiency

- Use high performance glass
- Use glass in appropriate orientation
- Smartly design building with shades, inclination etc. to reduce direct heat ingress
- Use IGU, if building design requires
- Use rated frames

Design factors impacting Glass Selection

**Climate Analysis:**
Climatic condition of the location is important to select type of glazing as different weather impacts differently.

**Optimum Orientation of Building:**
Before selecting any glazing material, study of building orientation is must, if rightly oriented, we may get energy efficiency without using high performance glass. (according to Indian context, South West orientation is responsible for maximum heat gain)

**Shadow Analysis:**
Shadow of the building as well as surrounding also impacts heat ingress (direct & defused), hence changes the glazing requirement.

**Daylight Analysis:**
Study of available lux level, window size and other passive design should be consider before defining the required VLT of a glass.
**Case Study**

* Image is placed only for representational purposes

**Project Details**
Location: Mumbai  
Orientation: East-West (longer sides facing North South)  
WWR-100%  
Glazing Area:  
North – 1500 sq m  
South – 1500 sq m  
East – 500 sq m  
West – 500 sq m

**Relative Heat Gain Assumptions**
ΔT – 4.5 deg C  
Peak Radiation for  
North – 518 W/ sq m  
South – 856 W/ sq m  
East – 619 W/ sq m  
West – 619W/ sq m
Relative Heat Gain Calculations
for Peak Load
Calculations are representative of 1 hour only
Detailed Calculations include 8760 hours

<table>
<thead>
<tr>
<th>Option</th>
<th>U-value/SHGC</th>
<th>NorthRHG</th>
<th>SouthRHG</th>
<th>EastRHG</th>
<th>WestRHG</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.7/0.8</td>
<td>440</td>
<td>710</td>
<td>521</td>
<td>521</td>
</tr>
<tr>
<td>2</td>
<td>5.7/0.45</td>
<td>259</td>
<td>411</td>
<td>304</td>
<td>304</td>
</tr>
<tr>
<td>3</td>
<td>3.3/0.45</td>
<td>248</td>
<td>400</td>
<td>293</td>
<td>293</td>
</tr>
<tr>
<td>4</td>
<td>3.3/0.3</td>
<td>170</td>
<td>272</td>
<td>201</td>
<td>201</td>
</tr>
<tr>
<td>5</td>
<td>2.8/0.25</td>
<td>142</td>
<td>227</td>
<td>167</td>
<td>167</td>
</tr>
</tbody>
</table>

Airconditioning Tonnage Calculations

<table>
<thead>
<tr>
<th>Option</th>
<th>U-value/SHGC</th>
<th>North</th>
<th>South</th>
<th>East</th>
<th>West</th>
<th>Total Tonnage</th>
<th>Savings % for tonnage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5.7/0.8</td>
<td>188</td>
<td>301</td>
<td>74</td>
<td>74</td>
<td>639</td>
<td>base</td>
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<tr>
<td>2</td>
<td>5.7/0.45</td>
<td>110</td>
<td>172</td>
<td>43</td>
<td>43</td>
<td>372</td>
<td>42</td>
</tr>
<tr>
<td>3</td>
<td>3.3/0.45</td>
<td>100</td>
<td>171</td>
<td>42</td>
<td>42</td>
<td>365</td>
<td>44</td>
</tr>
<tr>
<td>4</td>
<td>3.3/0.3</td>
<td>73</td>
<td>114</td>
<td>29</td>
<td>29</td>
<td>245</td>
<td>62</td>
</tr>
<tr>
<td>5</td>
<td>2.8/0.25</td>
<td>61</td>
<td>97</td>
<td>24</td>
<td>24</td>
<td>205</td>
<td>68</td>
</tr>
</tbody>
</table>

- Airconditioning Tonnage Calculations are based only on Peak Relative Heat Gain from the Glazing. These values do not include People, Equipment and Lighting.
Case Study

Energy Savings
Operating Hours – 8 hours per day
250 days in a year
Electricity Rate: Rs 12/unit
AC type: Air cooled Chiller

<table>
<thead>
<tr>
<th>Annual Electricity Consumption</th>
<th>Annual Electricity Cost</th>
<th>Capital Costs (AC)</th>
<th>Capital Costs (Glazing)</th>
<th>Total Capital Costs</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.7 lakh units</td>
<td>1.7 cr</td>
<td>base</td>
<td>1.4 cr</td>
<td>2.12 cr</td>
<td>base</td>
</tr>
<tr>
<td>8.55 lakh units</td>
<td>1.02 cr</td>
<td>73.6 lakhs</td>
<td>81 lakhs</td>
<td>1.08 cr</td>
<td>instantaneous</td>
</tr>
<tr>
<td>8.27 lakh units</td>
<td>99.3 lakhs</td>
<td>77 lakhs</td>
<td>1.32 cr</td>
<td>2.11 cr</td>
<td>instantaneous</td>
</tr>
<tr>
<td>5.04 lakh units</td>
<td>67.7 lakhs</td>
<td>54 lakhs</td>
<td>1.44 cr</td>
<td>1.98 cr</td>
<td>instantaneous</td>
</tr>
<tr>
<td>4.71 lakh units</td>
<td>56.53 lakhs</td>
<td>1.19 cr</td>
<td>45 lakhs</td>
<td>1.6 cr</td>
<td>instantaneous</td>
</tr>
</tbody>
</table>

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.

Retrofitting

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 high performance 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.
Product features:

- 1. A measure Against summer Heat – A measure for power saving and against the heat in summer
- 2. A measure against winter cold – Excellent heat insulation in winter
- 3. No need for Scaffolding for the installation – A short installation period (30 to 60 minutes per window) and low cost with the indoor installation.
- 4. The existing glass continues to be used, so its disposal is not required.
- 7. Unlike a heat shield film, periodic replacement is not needed.

WILD ATTOCH™

WILD ATTOCH™, external Installation Low-E Glass, enables single-story retail shops to do energy-saving reform without disrupting store operations.

Product features:
A. Simple “External” installation
   - External installation enables store renovation without disrupting business operations.
   - No curing required inside the store
B. Excellent heat insulation/shielding performance
   - Low-E glass alleviates summer heat and winter cold.
   - Heat insulation prevents dew condensation in winter.
   - 37.7% reduction in annual air-conditioning use
C. Solar control, UV blocking, etc.
   - Excellent solar control that eliminates the need for window shade
   - UV blocking function protects products from sunburn and color fade-out.
   - Large-sized glazing available
   - No need to remove/dispose existing window glass
**Effect of ATTOCH:**

<table>
<thead>
<tr>
<th>Outline of thermal environment calculation model</th>
<th>Before installation</th>
<th>After installation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summer</strong></td>
<td>Average indoor air temperature</td>
<td>27.4°C</td>
</tr>
<tr>
<td>Average temperature of facade glass surface</td>
<td>25.2°C</td>
<td>23.3°C</td>
</tr>
<tr>
<td><strong>Winter</strong></td>
<td>Average indoor air temperature</td>
<td>18.1°C</td>
</tr>
<tr>
<td>Average temperature of facade glass surface</td>
<td>22.8°C</td>
<td>21.6°C</td>
</tr>
</tbody>
</table>

This innovative technique of retrofitting helps to reduce air-conditioning energy use by about 30% a year.