What is Sustainability or Sustainable development..?
What is Sustainability or Sustainable development..?

Development → Technology → Sustainable & Efficient development → Sustainable society

- Social (Health benefits)
- Environmental (Reusable)
- Economic (Affordable)

Glass in Sustainable development & energy efficiency

- Energy efficiency
  - Social aspect
- Less Wastage
  - Environmental aspect
- Optimum Usage
  - Economical aspect
SOCIAL aspect of glass

**SICK BUILDING SYNDROME**

- A person sitting in a dark room
- Exposed to outside environment

**Energy Conservation Building Code (ECBC) for Glass**

- WWR (Wall window ratio) should not exceed more than 60%
- Different thresholds of SHGC for WWR <40% and 40%--<60%
- SRR (Skylight roof ratio) should not exceed more than 5%
- Different thresholds of SHGC for SRR <2% and 2%--<5%
Glass in Building Rating Systems

To ensure the optimum daylight inside the space. Different threshold as per building.

90% of the occupants should have outside environment view

To ensure the best visual and thermal comfort

The balance

Enhancing human life by improving our building’s efficiency

Daylight & Views

Energy

Thermal & Visual comfort
TECHNOLOGY 1: Generations in glass technology

1. Float glass
2. Tinted
3. Hard coating
4. Soft coating
5. High performance-Low e glass

Building Simulation & Software

The various building simulations:

- **Energy Simulation**
  - Energy Simulation is a process to devise simulation model for optimizing energy efficiency of the proposed building.
  - Building Model encompasses building geometry, spatial relationships, geographic information and quantities and properties of building components.

- **Daylight Simulation**
  - Daylight Simulation is a process to determine the areas that are well lit throughout the day-time operations and the areas where artificial lighting is necessary

- **Lighting Simulation**
  - Lighting Simulation is a process to determine the lux level through the lighting design for interior and exterior spaces
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Glazing selection Parameters

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aesthetic</td>
<td>Enhances look of the building</td>
</tr>
<tr>
<td>Energy Efficiency</td>
<td>It is a combination of lighting &amp; cooling energy saving</td>
</tr>
<tr>
<td>Improved Day-lighting</td>
<td>Reduces artificial lighting requirement by using glazing</td>
</tr>
<tr>
<td>Glare Reduction</td>
<td>It can defeat the purpose of using glass</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Glass</th>
<th>Colour</th>
<th>VLT</th>
<th>IR</th>
<th>ER</th>
<th>SF</th>
<th>SC</th>
<th>U value</th>
<th>RHG</th>
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<tr>
<td>A</td>
<td>Shade</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>%</td>
<td>W/m²</td>
<td>W/m².k</td>
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</table>

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.

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Energy and cost analysis

Orientation Analysis

<table>
<thead>
<tr>
<th>Glass</th>
<th>VLT</th>
<th>SF</th>
<th>U-Value</th>
<th>Rate (Rs. / sq. m.)</th>
<th>Daylight %</th>
<th>Total Electricity Consumption (KWH)</th>
<th>Annual Electricity Cost (Rs.)</th>
<th>Annual Savings (Rs.)</th>
<th>Glazing Cost (Rs.)</th>
<th>Extra Payment for HP Glass (Rs.)</th>
<th>Payback (Months)</th>
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<tr>
<td>base case</td>
<td>92</td>
<td>87</td>
<td>5.8</td>
<td>800</td>
<td>40</td>
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<td>46</td>
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<td>48</td>
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</tbody>
</table>

Result:
Climatic and Shadow Analysis and Building Energy Simulations were conducted using 'Ecotect' software and 'Design Builder' software, respectively. The end results clearly showed that the glazing enabled a high level of both energy and cost savings.
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Daylight Analysis:

Pink region shows area which will have glare. Grey indicates sub-optimal lighting.
In 2nd case, we can see reduction in glare area.

VLT 78%  VLT 21%

For a corporate building in Mumbai, daylight analysis was done for Clear Glass (VLT = 78%) and the high performance glass (VLT = 21%).

- Daylight analysis prevented overdesigning of the building and at the same time optimize VLT requirement.
- High performance glass was used to reduce cooling load without compromising on lighting load.

TECHNOLOGY 2: Retrofitting solution

WHEN YOU CAN'T REPLACE, UPGRADE with AIS Renew
AIS Offers

AIS-RENEW is a retrofitting solution, specially designed to give old buildings a new life.

This solution converts low performing fixed windows glass (SGU & DGU) of office buildings & stores into energy saving insulated glass units (DGU/TGU) simply by installing low-E glass from the inside.

AIS-RENEW enables achievement of the performance equivalent to DGU/TGU windows by attaching a pane of Low-E glass to the existing window pane from inside/outside.

---

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Performance Parameter Improvement

**Optimized Light Transmission**

**Dew Condensation Eliminated**

**Reduce Glare**

**Optimized Light Transmission**
TECHNOLOGY 3: Swytch glass

- Normally made from extra clear glass
- Wide variety of color tints available
- Works with a remote control device
- Activates in less than 10 microseconds
- Blocks off UV rays that are harmful
- Works in temperatures from 0° to 55°C
- Blocks up to 50% light in "Off" mode

SAFETY aspect of glass

AIS Pyrobel is the perfect solution against fire that helps reduce spread of fire and heat in times of an outbreak. It also helps in providing enough time to implement an evacuation plan.
ENVIRONMENTAL aspect of glass

**Recycled content**
Post consumer wastage-10-12%

- Saves natural resources
- Reduced GHG emission

**Energy drop of 2-3% for every recycled content use**

3R in Glass

Avoid wastage
Post industrial wastage-25-30%

ECONOMICAL aspect in glass

**Glass Selection: Orientation & Climate**
- Heat and glare

**Glass Selection: Space use**
- Percentage and properties of glass shall be decided on the space use
ECONOMICAL aspect in glass

LPD Reduction
- Optimum daylight ingress would lead to savings in lighting.

Reduced HVAC loads
- Proper selection glass properties will lead to cooling loads

Reduced capital cost

Smart investment

- [Smart investment diagram]
Glass is Green

Glass is an expensive building material.

Excess use of glass in campus will lead to heat island effect.

If WWR is kept more than 60%.

Retrofitting of building demands dismantling of the glass for better performance of glass façade. It turns out to be an expensive affair.

GLASS: Potential Credit Categories

- Sustainable Sites
- Water Efficiency
- **Energy Efficiency**
- Materials & Resources
- Indoor Air Quality
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Thank You