The Role of Glass in Sustainable Architecture in warm / hot climates
Assalaam Alaykum

Sayadaati wa Sadati

Ahlan Bikum

Good Afternoon

Bonjour

Guten Tag

Goede Middag

Isme Alistair Kellock min El Emaarat
2 AREAS FOR DISCUSSION

1. The role of glass in Sustainable Architecture

2. The need for: Building Regulations and Product Standards
but first a few words about the

Glass & Glazing Federation

• Established in 1977

• A ‘Not For Profit’ Organisation

• The Largest Federation in the Glass industry worldwide -
  ➢ over 500 members worldwide
  ➢ UK members represent 60% of the UK’s industry turnover
  ➢ members in USA, Germany, Australia, India, the Far & Middle East,
  ➢ including Egypt

• Represents the interests of its members, and the public, on a wide range of glass-related issues:

• Lobbies Governments & Authorities around the world to promote an understanding of how best to employ the many benefits of Glass

• Drafts & Implements :
  Codes of Practice
  Building Regulations
  Standards – BS, EN, ISO etc
Q.: Why is the GGF the largest Federation in the Glass World?  
A.: Because we are Active & Effective, our efforts are appreciated by members, private clients and Government authorities.

Q.: Why are we here in Cairo?  
A.: Because we have new members here and there is an increasing declared interest to improve industry standards.

The Gulf Region of the GGF held its 1st meeting in 2007  
The M.E.N.A Region ?? – Bucra Malesh Inshaalah !!
The role of Glass in Sustainable Architecture in warm / hot climates
Basically, we have a choice ……
... we can continue to tolerate this level of Pollution, or we can start to do something about it ....
.... for future generations ???
Going Green

Are we really thinking **Green**

or just different Shades of **Grey** ??
Factors influencing your choice of Glass:

- It looks nice
- It’s a Pretty Colour
- It keeps the wind and rain out
- It provides some privacy
- It allows me to see out
but today the decision-making process has to be more sophisticated

- We have a duty to think about the environment:
- A duty to ourselves
- A duty to our fellow mankind
- A duty to our children & their children
Glass Related - Sustainability Factors

Sourcing of Raw Materials to make Glass:
- Sand
- Soda Ash
- Dolomite
- Limestone
- Etc
Glass Related – Sustainability Factors

In 2010

3 Float Glass Producers in Egypt.

Greatly reducing the Energy Cost & Carbon Footprint of Transport.

Approx 20% of Raw Material is Recycled Broken Glass
Glass Related – Sustainability Factors

- **Solar Control** (Reducing HVAC Load)
- **Daylighting** - Higher Light Transmissions (Reducing Artificial Lighting)
- **Insulation** – Thermal & Accoustic
Driving Factor in Energy Conservation is the Shading Coefficient (or Solar Heat Gain Factor)

For Energy Conservation, the ‘U’ Value is of Marginal benefit

Keep the Heat OUT!!
Cooling - **not** heating is the single largest Energy cost facing the majority of buildings in this Region.
Relative Heat Gain (RHG)

The RHG summarises the Total amount of Solar Energy entering a building. It is the balance between the Shading Coefficient (SC) & the ‘U’ Value – taking account of Heat entering thru’ Radiation, and Conduction & Convection, for a specific set of conditions.

[This value considers indoor/outdoor temp. differences, and the effect of solar radiation.]

Relative Heat Gain (RHG) W/m² = ‘U’ Value x 7.8°C + SC x 630

If ‘U’ value is 2.1 W/m²K and SC is 0.35

RHG = 2.1 x 7.8 + 0.35 x 630
RHG = 16.38 + 220.5
RHG = 236.88 W/m²

‘U’ value is only 1/14<sup>th</sup> of the total Relative Heat Gain

Focus on the Shading Coefficient (SC)
Why do we need Solar Control Coatings?
What do they do for us?
Increased energy costs in the early 1970’s prompted the development of solar control coatings.
Evolution - Dubai

1950’s 1970’s 2010
In the 1980’s & ’90’s

In this climate, we still had little choice but to use **Highly Reflective** glasses to kick-out the Solar Energy.

Imagine how much you pay to stay in these buildings, with 8%-20% Light Transmission and look at yourself in a mirror at 4.00pm everyday – what happened to the view ??

Thankfully - Technology has moved-on ....
Ongoing Improvements in Coating Technologies permitting:

High Light Transmission with good Shading Coefficients

Low Int & Ext Reflectivity

= Greater Feeling of Contact with our Environment

= Psychological Impact – greater Productivity and improved Comfort
The Solar Energy Spectrum
The Solar Energy Spectrum

Ultra Violet (3%): 300 – 380 nanometers
   Damaging (12%): 300 – 600 nanometers
Visible (43%): 380 – 780 nanometers
Near Infrared (54%): 780 – 2500 nanometers
Heat Energy (50%): 400 ~ 1750 nanometers
Visible Light Spectrum

Outdoor Reflectivity 0-100%

Visible Light Transmission 0-100%

Indoor Reflectivity 0-100%

Coating
100% Solar Energy = R.A.T.

Absorbed energy is dispersed by action of the wind.
### Capital Cost vs Running Cost

Select the Right Glass from the outset:

Save on Capital Cost and Running Cost of Air-Con

<table>
<thead>
<tr>
<th>Glass Type (6-12-6) with air infill</th>
<th>High Performance IGU</th>
<th>Low Performance Unit</th>
<th>Variance $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price ($/m²)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cost difference for a 10,000 m² Facade</td>
<td>82</td>
<td>41</td>
<td>410,000</td>
</tr>
<tr>
<td><strong>Performance (Total Heat Gain)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Shading Coefficient (SC)</td>
<td>0.34</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>U-Value (summer) (U) - W/m2.K</td>
<td>1.9</td>
<td>2.3</td>
<td></td>
</tr>
<tr>
<td>Relative Heat Gain (RHG) - W/m² (ASHRAE - summer)</td>
<td>229</td>
<td>396</td>
<td></td>
</tr>
<tr>
<td><strong>Energy Consumption - 10 hrs per day per m² (KWHr)</strong></td>
<td>2.3</td>
<td>4.0</td>
<td></td>
</tr>
<tr>
<td><strong>Energy cost per m² for 10-hour day:</strong></td>
<td>0.15</td>
<td>0.26</td>
<td></td>
</tr>
<tr>
<td>(Based on US$ 0.065 per Electrical Unit (1 Electrical Unit = 1 KWHr.)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Monthly energy cost per m² (30-day month) (US$)</strong></td>
<td>4.5</td>
<td>7.8</td>
<td></td>
</tr>
<tr>
<td><strong>Monthly energy cost</strong> for a glazing of 10,000 m² (30-day-month) (US$)</td>
<td>45,000.00</td>
<td>78,000.00</td>
<td></td>
</tr>
<tr>
<td><strong>Annual energy cost</strong> for a glazing of 10,000 m² (US$)</td>
<td>540,000.00</td>
<td>936,000.00</td>
<td></td>
</tr>
<tr>
<td><strong>Energy savings for a 20-year building life</strong></td>
<td>7,920,000</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Sustainability – Efficient Glass + Wind Turbines

Bahrain World Trade Center
LEED Certification:
First Platinum Rated Building in the Middle East

We Created History.
1st Platinum Rated Green Building in the Middle East & 16th in the World.

Pacific Controls Headquarters
Main Features: 90 Tons of Solar Powered Air-conditioning • 50 KW of Solar Powered Lighting • 100% Waste Water Recycling • Recycled Construction Materials • Environmentally Friendly Materials • Indoor Environmental Quality • Low Emitting Materials • Stairs of the All Fully Transparent Web Enabled Building Controls • Wireless Mesh Networking Enabled Building Controls • AOM (Machine to Machine) Connectivity Enabled • Device & Enterprise Connectivity • Distributed Hardware and Software Architecture

Pacific Controls is proud to be the winner of The BuiLConn, Buidy 2007 Award for the Best Intelligent Building in the World, awarded to us in Chicago, IL, USA, on 24th May 2007.

www.builconn.com

www.pacificcontrols.net
Now – let’s harness the Power of the Sun to our benefit ....

The sun is the answer.
If they can do it – where the Sun
don’t shine – much …

Photo Voltaic Spandrel Panels
B.I.P.V. – Manchester, England

... so can we - JALLA !!! NIMSHI !!!
Domestic Solar Thermal Collectors

With Glass Vacuum Tubes
PV Panels on Homes & Outbuildings
Building Integrated Photo-Voltaics

B.I.P.V.
PV Solar Farm
The GGF cooperates with, and advises many organisations worldwide, who are promoting GREEN Building principles

Independent Agency based in UK
Certification - BREEAM
Building Research Establishment – Environmental Assessment Method

Non Profit Organization in USA
Certification - LEED
Leadership in Energy and Environmental Design
Non Profit Organization in Australia Certification – Green Star

French Environment and Energy Management Agency – under the supervision of French Government. Certification – HQE (High Environmental Quality)

GRIHA National Rating System Governmental Agency in India Certification – 5 Star Rating
Independent Organization based in Dubai.

Helping with LEED Certifications

Agency of Government of Abu Dhabi

Certification : Pearl Rating System
It’s a long road but …. we have to start sometime

Shuwayyah
Shuwayyah !!

The **Right**
Glass in the **Right** Place
The need for Building Regulations & Standards
• Carrot or Stick

• Positive or Negative Incentives?

I know which one I respond to better!!
Codes of Practice
Building Regulations Standards

To control:
• Energy Consumption
• Noise Pollution
• Safety: Impact / Accident
  Fire
  Bullet
  Bomb Blast
  and ....
... to control
Product Quality
... to control that the glass is Fit for Purpose

It is not sufficient to specify and select the Right Glass in the Right Place – we must also ensure that the products sold are, in fact, manufactured in the correct manner – to the Specified STANDARD
Companies who have invested in quality equipment, and in training skilled employees, deserve to be protected from having to be compared to, and competing with, companies who do not care about Quality, or your safety, and are unable to manufacture and deliver Products of an acceptable Quality Standard.
Glass in building —
Security glazing —
Testing and
classification of
resistance against
manual attack

EGYPTIAN STANDARD
MEQYAS MUSRIYA

The European Standard EN 356:1000 has the status of a
British Standard

BSI

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Dubai Building Regulation

Decree 66 of 2003, Dubai Municipality

<table>
<thead>
<tr>
<th>Location</th>
<th>U Value (W/m²K)</th>
<th>Shading Co-efficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glass Openings (10 – 40%)</td>
<td>&lt; 3.28</td>
<td>&lt; 0.40</td>
</tr>
<tr>
<td>Glass Openings (exceeds 40%)</td>
<td>&lt; 2.1</td>
<td>&lt; 0.35</td>
</tr>
<tr>
<td>Showrooms</td>
<td>&lt; 2.5</td>
<td>&lt; 0.76</td>
</tr>
<tr>
<td>Skylight</td>
<td>&lt; 2.1</td>
<td>&lt; 0.35</td>
</tr>
</tbody>
</table>
## Bahrain Building Regulation


<table>
<thead>
<tr>
<th>Location</th>
<th>U Value (W/m²K)</th>
<th>Shading Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Curtain Wall</td>
<td>&lt; 2.1</td>
<td>&lt; 0.25</td>
</tr>
<tr>
<td>Door &amp; Windows IGU</td>
<td>&lt; 2.4</td>
<td>&lt; 0.44</td>
</tr>
<tr>
<td>Single Glass</td>
<td>&lt; 5.1</td>
<td>&lt; 0.50</td>
</tr>
<tr>
<td>Skylight</td>
<td>&lt; 2.0</td>
<td>&lt; 0.25</td>
</tr>
</tbody>
</table>
Safety and Security
How is Safety Glass Classified?

Safety glass is commonly expressed in International Standards (EN, ASTM, etc) as one which will either:

• not break – under a specified impact
  or
• break safely.

The safe breaking characteristics are usually further described as not allowing large shards of glass that could cause piercing & life-threatening injuries.
Safety Risk Locations
Safety and Security Glazing

- Tempered Glass
- Laminated Glass / Anti Burglary Glass
- Fire Resistant Glazing
- Bullet Resistant Glazing
- Blast Resistant Glazing
Burglar resistant

- Laminated Glass
- Minimum 1.14mm PVB
- Axe Test
- Ball Drop Test
- Penetration resistance vs time
The Bat Test
Blast Resistant
Government Test Chamber
Bomb Blast
Military Bomb Test Station
Bullet Resistant

Multi-layers of glass and PVB or Glass PVB, PVC and polycarbonate are used to absorb projectile impact.
Fire Resistant Glazing
It may appear to be a Marathon task but …
Together, we can take One step at a time.

Wahdah
Wahdah !!
... and we’ll make a difference for ourselves and our children
SHUKRAN JAZILAN

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