Electronically Tintable Glass as an Architectural Enabler

Helen Sanders and Lou Podbelski
Why is dynamic solar control on façades so important?
Impact of Façade Technologies on Energy Usage in US Building Stock

- Integrated Insulating Dynamic Façades
- Highly Insulating Dynamic Windows
- Triple pane low-e
- Dynamic low-e
- Low-e
- Average Properties of Windows Sold Today
- Current Building Stock

Annual Energy Usage, Quads

Heating
Cooling
Lighting
Example EC Glass Performance

GLAZING PERFORMANCE COMPARISON

Solar Heat Gain Coefficient vs. Visible Light Transmission (%)

- **Glare control without needing shades/blinds**
- Reflective
- Tinted
- Tinted low-e2
- Low-e2
- Low-e3

ELECTROCHROMIC GLAZING PERFORMANCE
How EC Products Work

Clear State

- Low voltage DC
- Argon filled
- Low-e coating (surface 2)
# Key Benefits of Electronically Tintable Glass

<table>
<thead>
<tr>
<th>Energy and Operating Cost Reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Reduces energy (heating, cooling, lighting) loads by up to 20%</td>
</tr>
<tr>
<td>✓ Lowers peak demand power requirements by up to 26%</td>
</tr>
<tr>
<td>✓ Eliminates need for blind / shade maintenance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Upfront Cost Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Reduces overall HVAC equipment requirements up to 25%</td>
</tr>
<tr>
<td>✓ Decreases ductwork size</td>
</tr>
<tr>
<td>✓ Eliminates the need for both interior and exterior shades</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupant Benefits</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Maintains occupants’ view and connection to outdoors</td>
</tr>
<tr>
<td>✓ Harvests natural light – allows more glass without penalty!</td>
</tr>
<tr>
<td>✓ Improves comfort and productivity</td>
</tr>
<tr>
<td>✓ Provides fading protection</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Building Value Enhancement</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓ Provides up to 12 LEED® points</td>
</tr>
<tr>
<td>✓ Enhances buildings’ sale and rental value</td>
</tr>
</tbody>
</table>
Case Studies
HVAC Free Space: Chabot College, Hayward, CA
Phil Newsome, tBP Architecture:

The design approach we’ve taken...delivers exceptional energy efficiency due in large part to a ductless heating and cooling system.

That system would not be possible without deploying EC glass. This revolutionary “dynamic glass” controls the amount of sunlight entering the two-story space.

As a result, it’s become an architectural enabler that has allowed us to create an HVAC-free space.”
Ryan Benson of Schmidt Associates:

“EC glass was the best option .... because it enabled us to maximize natural light and a view to the outdoors, while creating a space that’s thermally and visually comfortable for the students inside.”

EC glass enabled him to incorporate more glass into the project without compromising on energy efficiency and a view to the natural outdoors.
Gary Canaday
Manager of Campus Construction, Facilities Planning & Mgt

“We previously had regular glass skylights, but blinding glare and heat was a problem. We looked at installing mechanized shades and blinds, but that option was not attractive and would have created on-going maintenance issues.

EC Glass controls the sunlight and heat that enters and leaves the building, reducing our energy use while enhancing and increasing students’ use of the space,“
Enabling a Multi-Use Space: Immanuel Bible Church, Springfield, VA
Louver-Less Design: Siemens Wind Turbine Facility, Hutchinson, KS
Siemens Wind Turbine Facility, Hutchinson, KS
Randall Vaughn, architect, Gray Construction

“We explored several options, including *mechanical sun shades, blinds and louvers*, as well as extended overhangs and canopies,”

“All of *these options detracted* from the design and sustainability goals of the project.”

*EC glass* provided an *elegant solution* to our sun challenges by changing from a clear to a tinted state in response to changing light conditions.”
Siemens Wind Turbine Facility, Hutchinson, KS
Making the Building Work For the Purpose:
Port of Entry, Torrington, WY
Doug Selby, Douglas Selby & Associates,

“EC glass allowed the Wyoming DOT Port of Entry staff to have *full view* of trucks on the highway and those circulating through the Port without the need for interior blinds or exterior louvers on the windows to control summer and winter glare on the west and south elevations”
Historic Preservation – Without Compromise
St. Johnsbury Athenaeum, St. Johnsbury, VT

- Fading protection
- Enhancement of art viewing
- Preserve authenticity
- High energy performance
## Fading Protection

### Glass Type

<table>
<thead>
<tr>
<th>Glass Type</th>
<th>Tdw-K</th>
<th>Tdw-ISO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clear Glass</td>
<td>45%</td>
<td>30%</td>
</tr>
<tr>
<td>Low-E2</td>
<td>77%</td>
<td>52%</td>
</tr>
<tr>
<td>EC Glass (clear state)</td>
<td>82%</td>
<td>62%</td>
</tr>
<tr>
<td>EC Glass (tinted state)</td>
<td>98%</td>
<td>97%</td>
</tr>
</tbody>
</table>

- **Tdw - K**: Weighted transmission of the sun’s energy that causes fading using the Krochmann Damage Function (300 - 500nm)
- **Tdw - ISO**: Weighted average of the sun’s energy that causes fading using a function developed by the International Commission on Illumination (300 - 700nm)
- Data from Lawrence Berkeley National Laboratory’s Window 5.2 software
John Mesick, Project Architect

“It’s the oldest art gallery still in its original form in the US. … it was critical that the skylight project preserve the unique and authentic atmosphere that people experience when they visit,”

“Using traditional glass with mechanical shades or other sun controls would have severely compromised the aesthetic appeal of the gallery.”
Matthew Powers, Executive Director, Athenaeum

"The Athenaeum was built by individuals in the 19th century who embraced and promoted innovative technologies and design.”

“Today, we continue this tradition ..... EC glass will provide energy savings, protect our important collection from harmful UV solar radiation and enhance our visitor experience."
Daylighting Optimization: Zoning
Benefits Compared to Conventional Mechanical Shading Options

• Low maintenance
• Functions in all weather
• Applicable to all climates (even the desert)
• Fully effective on all elevations
• Less space than a double skin curtainwall
• Clear, unobstructed views
• Clean look to the façade
• No bird perch/nest issues or falling icicles
• Better energy performance c.f. interior shading systems
• EC prices comparable and falling steadily as volumes increase
Up-front Cost Comparison

Conventional Solutions

- Increased HVAC
- Sunshades
- Low-e IGU
- Automated Blinds

EC Glass

EC Glass
EC Glass – Enabling Architectural Design

- Enabling sustainable designs
- Greater design freedom without compromises
- Use more glass without energy or comfort penalty
- Elegant and simple façade designs
- Enabling unobstructed views – no shades/blinds
- Enabling multi-use spaces with glass
- Communal spaces AND office spaces

Contact: Helen Sanders
Helen.sanders@sageglass.com