Façade Retrofit for Thermal Comfort and Energy Saving

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What is the demand Today?

For new projects, Owners, Architects and Façade consultants may consider a lot of things.

But we have already a lot of existing old buildings. Today I want to introduce solutions for Renovation.
What is ATTOCH?

- ATTOCH is the insulating glass retrofit for existing building from inside of the building. ATTOCH is our creative word.
  - Ato; This meaning is “After” in Japanese.
  - Attach; Fasten one to another.
- On-site fastening of new high performance glass to Existing Glass. Without external scaffold, installation work was carried out from inside of the building.
Retrofitting Problems of Existing Building

- Inconveniencing existing tenants.
  - Disruption to existing operation.
  - Need for openings or displacements of existing windows.

- Prolonged renovation period
  - Need for setup and dismantling of scaffolding

- Glass replacement is usually of lower priority
  - Unnecessary load on current cooling system
  - Affects thermal comfort, acoustic comfort

**Solution**: The on-site insulating glass retrofit for existing building!
On-site insulating glass retrofit provides 5 values:

- Comfortable
- Energy Saving
- Smart Installation without scaffolding
- No stopping of business activity
- No big change in appearance
- Sound insulation
Cut heat from outside and Keep cool in room

Comparison of solar shading:
- Single clear glass: SHGC 0.97
- ATTOCH: SHGC 0.54

Comparison of thermal insulation:
- 5.9 W/m²-K (single clear glass)
- 1.6 W/m²-K with ATTOCH

ATTOCH can provide cooler space beside window
Thermal performance of AGC HQ

Improvement

Difference

Room temp: 3.1°C
Black Cloth: 10.1°C

Without ATTOCH

Inside

30.6°C

With ATTOCH

Inside

27.5°C

Air con temperature

26.0°C

Surface on black cloths

42.3°C

Surface on black cloths

32.2°C

Measured 1m away from window
We compared the thermal performance in same size room.

<Comparison for cooling energy consumption in Summer>

25% reduction
Comparison on Economy

Better Cost Reduction with ATTOCH™ in a long term period!

Image: Total Cost Comparison for Renovation Solution

- Glass & Sash Replacement
- Cost saving effect of cooling system energy consumption
- Heat shading film
- Heat shading film to be replaced every 5-7 years

© Cost Index: Cost of sash replacement is taken as 100.
*Graph is subject to actual condition
What type of glass is suitable for glass retrofit?

Coated Products

- **Pyrolytic Coating**
  - Solar Control Reflective
  - Stopsol Classic
  - Stopsol Supersilver

- **Magneton Sputtering Coating**
  - Solar Control Reflective
  - Solar Control Low E
  - Sunergy Clear, Cool, Tinted
  - Sunergy Sigma Planibel G (Low E only)
  - T-Sunlux
  - Stopray Ace
  - Stopray Vision
  - Stopray Smart

**Strength of Online Coating**

- High Durability & Resistances: Scratch, Chemical, etc...
- Easy Handling for Glass Processing
- Versatile: Can be used Single or double glazed.

**Strength of Offline Coating**

- Various Materials Combination
  - Higher Energy Performance
  - Variety: Various Color Appearance

Float Online Production

- Under coater – layer #1
- Top coater – layer #2

Process flow Sputter

Glass Temp. 600°C ~ 700°C

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Comparison: Clear vs Solar Control Low-E

Clear Float 6mm monolithic

High temperature of 41.5 deg for the area near the glass

Sunergy Cool 6mm monolithic

Warm temperature of 32.5 deg for the area near the glass

Solar Control Low-E glass can reduce the temperature.
- **WWR (Window to Wall Ratio)** & **SC (Shading Coefficient)** are dominant factors.
- **Solar Heat gain from window** should be a most considerable term in OTTV

Solar incident: **194 W/m²**

- **U Value (Window)**: **10% to 20%**
- **U Value (Wall)**: **0.2% to 5%**

**Area (window) / Area (window + wall)**

**Solar heat gain from window**

\[ 194 \times OF \times WWR \times SC \]

**Thermal transfer through window**

\[ 6 \times WWR \times U_f \]

**Thermal transfer through wall**

\[ 15 \times \alpha \times (1 - WWR) \times U_w \]

REF: MS 1525:2014
## Proposed structure “Green tinted base”

<table>
<thead>
<tr>
<th>Existing Glass</th>
<th>Attoch Glass</th>
<th>LVT(%)</th>
<th>SC</th>
<th>U-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Green tinted 6mm (Panasap Green)</strong></td>
<td>-</td>
<td>69</td>
<td>0.63</td>
<td>5.7</td>
</tr>
<tr>
<td></td>
<td>Clear FL 6mm</td>
<td>61</td>
<td>0.50</td>
<td>2.8</td>
</tr>
<tr>
<td></td>
<td>Sunergy Clear 6mm #3</td>
<td>48</td>
<td>0.44</td>
<td>2.1</td>
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<tr>
<td></td>
<td>Sunergy Cool 6mm #3</td>
<td>35</td>
<td>0.42</td>
<td>2.3</td>
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<tr>
<td></td>
<td>Sunergy Cool 6mm #4</td>
<td>35</td>
<td>0.40</td>
<td>2.5</td>
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<tr>
<td></td>
<td>Sunergy SIGMA Green 6mm #3</td>
<td>27</td>
<td>0.36</td>
<td>2.3</td>
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<tr>
<td></td>
<td>Sunergy SIGMA Green 6mm #4</td>
<td>27</td>
<td>0.37</td>
<td>2.5</td>
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<tr>
<td><strong>Sunergy Clear 6mm #2</strong></td>
<td>Green tinted 6mm (Panasap Green)</td>
<td>48</td>
<td>0.55</td>
<td>2.1</td>
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<tr>
<td></td>
<td>Clear FL 6mm</td>
<td>62</td>
<td>0.60</td>
<td>2.1</td>
</tr>
<tr>
<td><strong>Sunergy SIGMA Green 6mm #2</strong></td>
<td>Green tinted 6mm (Panasap Green)</td>
<td>27</td>
<td>0.29</td>
<td>2.3</td>
</tr>
<tr>
<td></td>
<td>Clear FL 6mm</td>
<td>35</td>
<td>0.31</td>
<td>2.3</td>
</tr>
</tbody>
</table>
Required SC & U to meet regulation

On-site Low-E IGU on Green glass can meet regulation.

* Aspect E:S:W:N=1:2.5:1:2.5, WWR=0.5
Uwall=0.92
Glass size:
about 1400mm * 2765 mm (3.87m², 77kgf)
Attoch: Sunergy tempered 8 mm thickness.
Existing glass façade is glass fin type.

Now started on site.
Measurement to verify the performance.
Case(2): Office in Malaysia (Facade Facing West)

ATTOCH™ helps in reducing the globe temperature by 4°C
Project Case Study in Malaysia

[Diagram of a building section with various elements labeled such as window, glass, and special setting block.]

(A-A' PLAN)

<Section>
### Table: Thermal Performance Comparison

<table>
<thead>
<tr>
<th>Item</th>
<th>Uf</th>
<th>SC</th>
<th>Thermal transfer through wall</th>
<th>Thermal transfer through window</th>
<th>Solar heat gain from window</th>
<th>OTTV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>5.67</td>
<td>0.53</td>
<td>2.2</td>
<td>11.6</td>
<td>64.4</td>
<td>78.2</td>
</tr>
<tr>
<td>Clear</td>
<td>2.36</td>
<td>0.36</td>
<td>2.2</td>
<td>4.8</td>
<td>43.8</td>
<td>50.8</td>
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<tr>
<td>Euro Grey</td>
<td>2.36</td>
<td>0.31</td>
<td>2.2</td>
<td>4.8</td>
<td>37.7</td>
<td>44.7</td>
</tr>
</tbody>
</table>

### Box 1: Aspect E:S:W:N=1:2.5:1:2.5, Uwall=0.92, WWR=0.6

### Box 2: Diagram of U-value distribution

- **U-value Chart**
  - 78.2 W/m²
  - 50.8 W/m²
  - 44.7 W/m²

### Diagram Details

- **U-value Range**
  - 0 to 5.5
  - 0.00 to 0.70

- **Legend**:
  - 10.00-20.00
  - 20.00-30.00
  - 30.00-40.00
  - 40.00-50.00
  - 50.00-60.00
  - 60.00-70.00
  - 70.00-80.00
  - 80.00-90.00
  - 90.00-100.00
  - 100.00-110.00

- **Legend Colors**:
  - Orange
  - Red
  - Blue

- **Legend Text**:
  - Meet regulation >50 W/m²
Smart Installation solution

Install from inside
No need **Scaffolding**
Quick renovation

Install from outside
No need to stop business
Quick renovation

For ground floor
Thermal performance of Thailand Project

Wild Attoch for 7-11 Shop

Measurement from inside
Thermocouple & thermo-device
Thermo-meter of outside
Solar radiation meter & Globe thermometer

Globe Temp.

7.5 °C
Another Smart Installation

**Before AIW**
- More HEAT
- More NOISE
- Less COMFORT

**After AIW**
- Less HEAT
- Less NOISE
- More COMFORT

**Improvement in Performance after ATTOCH™ Inner Window (AIW) Installation**

<table>
<thead>
<tr>
<th>S.No</th>
<th>Parameters</th>
<th>Before AIW</th>
<th>After AIW</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Glass Surface Temperature</td>
<td>46.8°C</td>
<td>37.2°C</td>
<td>9.6°C</td>
</tr>
<tr>
<td>2.</td>
<td>Room Temperature</td>
<td>31°C</td>
<td>26°C</td>
<td>5°C</td>
</tr>
<tr>
<td>3.</td>
<td>Globe Temperature</td>
<td>35.4°C</td>
<td>29.1°C</td>
<td>6.3°C</td>
</tr>
</tbody>
</table>
Improve Energy Efficiency & Thermal Comfort for Existing Buildings

Thank you for your attention.