THERMALSWITCH FAÇADE
There are four different types of facade renovations: Replacement, Recladding, Overcladding and Double Skin. When it comes to the preservation of a landmark building, like The Metlife Building, the first two could be argued as the most appropriate, although probably not the most financially feasible.

The Thermalswitch facade looks at hybridizing the overcladding and double skin techniques to create a unitized frame which mounts directly over the existing precast panels. The Metlife facade is constructed of a primary precast panel with integrated fins on both sides that alternates every other bay. Between these primary panels, secondary infills are set at the spandrel conditions.

Because the Thermalswitch unit is designed to fit over the existing single floor unit, once the units are unloaded on a floor above, the existing glazing is removed and they are set via a custom horizontal slide and floor crane through the opening of the precast unit.

The crew on the reclad floor are tied off and can set temporary ledges off the precast unit to receive and anchor the Thermalswitch unit to the precast facade. Once this is set, the rough opening can be reglazed with a new fiberglass frame that features an integrated trickle vent at the head to complete the recladding.

This overcladding only requires two floors to be vacated at a time; the loaded floor and the recladding floor. As the crew moves up the building the loaded floor becomes the reclad floor while the remainder of the offices above and below can continue to occupy the space until the reclad has reached them.
1. REPLACE EXISTING GLAZING FRAME (WITHOUT IGU)
2. ETFE UNIT HUNG FROM FLOOR ABOVE
3. ETFE UNIT SET AND ANCHORED
4. INSIDE GLAZE FRAMING

RANGE OF TILT

\[ \pm 24^\circ \]
The concept behind the Thermalswitch facade unit is to create a double skin. The cavity in the double skin is a slightly vented, preconditioned cavity that tilts away or towards the sun depending on the temperature by utilizing Nitinol wire. Unlike most applications where a current is run through the wire, in the Thermalswitch unit, the Nitinol is activated by the ambient temperature within the cavity.

This tilting action, along with the various venting components at the top and bottom of the unit, creates a convection current which will pull outside fresh air into the cavity and warm it as it enters the office space, or vents hot air out by drawing cool air from the building core.
CONTRACTING NITINOL SPRING CONNECTION

VENTS AT SILL OPEN WHEN ETFE IS STRETCHED

CONTRACTING NITINOL WIRE CONNECTION

VENTS AT HEAD OPEN WHEN ETFE IS STRETCHED
The thermal analysis shows that simply replacing the existing glazing with a new fiberglass frame and IGU with a Low-E coating does not increase the performance of the enclosure a great deal. However, by creating a preconditioned, slightly vented cavity between the existing precast and the exterior (17.3°F) the overall assembly mediates the temperature gradient better than only replacing the glazed portion of the facade.
This analysis quantifies that overcladding the existing precast facade with the Thermalswitch unit increases the thermal performance and relieves condensation potential while pushing the dewpoint into the center of the precast rather than the occupiable space.
Traditional standards on the Daylight Factor, as defined by the UK and North American authorities, ranges from 2% minimum and higher. The LEED scoreboard also offers 1 credit for all buildings that can achieve a minimum of 2% in 75% of all spaces which require regular visual tasks.

In the Metlife building, the original facade allows 3.01% DF, which still requires additional lighting some of the time. With the addition of the Thermalswitch facade, the DF is only slightly reduced in both the summer and winter orientations. Winter seeing only a 0.45% reduction and the summer a 0.875% reduction, which is above the minimum requirements. Overall the recladding does not significantly reduce the daylight factor from the original design.
EMBODIED ENERGY

The unitization of ETFE and fiberglass pultrusions, instead of aluminum and glass, reduces the embodied energy of the systems while increasing the thermal performance. While ETFE has a higher MJ/kg, the overall mass of the ETFE required to skin the building is substantially less than a glass overcladding unit.

<table>
<thead>
<tr>
<th>Material</th>
<th>MJ/kg</th>
</tr>
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<tbody>
<tr>
<td>FRP - Virgin</td>
<td>33</td>
</tr>
<tr>
<td>ETFE</td>
<td>120</td>
</tr>
<tr>
<td>Vs.</td>
<td></td>
</tr>
<tr>
<td>Aluminum - Virgin</td>
<td>218</td>
</tr>
<tr>
<td>Aluminum - Recycled</td>
<td>33.4</td>
</tr>
<tr>
<td>Glass - Tempered</td>
<td>26.2</td>
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</tbody>
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In addition to the embodied energy analysis, the Thermalswitch unit directly affects the operation of the building's mechanical equipment. With the addition of the Thermalswitch facade, the building does not have to utilize heating and cooling units. Because New York is a predominantly cooling loaded, the preconditioned air passing through the facade into the spaces in the winter could be passively heated by the unit to ~55-60°F. In the summer, the unit will pull air from inside the occupied space by positively pressurizing the building core. The cool air from within the core will be drawn into the spaces, cooling the occupants as it is pulled through the facade.