Design Concept

Where, What, Why

Energy Design Approach – ZEB

Focused on:
- Highly efficient Envelope
- Maximizing passive strategies

Climate Insertion in Design

Expected Result:
Building is an expression of its active and passive solar technologies
Integration of Solar Energy in Envelope (Facade) - Active and Passive Strategies

1. Photovoltaic (PV) glazing - Windows on East and West Facades

2. Thermally Break Windows (Openable) - North Facade

3. External Insulated Wall for energy conservation

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**Electrical Parameters**

(1000 W/m², 25°C)

- Nominal Peak power (Pmpp): 78 W
- Peak power voltage (Vmp): 15.14 V
- Peak power current (Imp): 5.15 A
- Open circuit voltage (Voc): 17.95 V
- Short circuit current (Isc): 5.49 A

**See-through Solar Cells**

- Cell Type: Mono-crystalline 125 * 125mm
- Efficiency = 19%
- Cell number = 7*4 PCS
- U-value = 6.0

**Energy Detail**

- Type: Single Brick
- Total thickness: 225.0mm
- Resistance (R): 0.4167 (m² K)/W
- Thermal Mass: 27.22kJ/K

- Type: Insulated Wall Assembly
- Total thickness: 485.0mm
- Resistance (R): 7.0056 (m² K)/W
- Thermal Mass: 37.82kJ/K
Integration Of Solar Energy In Envelope ( Roofs)

Transparent Photovoltaics Sky Light roof

Building Integrated Photovoltaics
Photovoltaics Glass Skylight - BIPV

Material Data

- Cell Type: Polycrystalline
- Dimensions: 1640x992x35 mm
- Weight: 19 kg
- Glass Thickness: 3.2 mm

Thin Film (a-Si) - Degree of Transparency 40%

Maximum Power (Pmax)
- 121 Wp

Voltage at Maximum Power (Vmpp)
- 140 V

Current at Maximum Power (Impp)
- 0.87 A

Panel Efficiency
- 4 %

Electrical Data at STC

1. Flat Aluminium hood
2. Insulation
3. Double glazing
4. Photovoltaics (Glass-glass)
5. Protected Wiring and Mask

Technical characteristic

- Flat Aluminium hood
- Visible Surface - Interior 60mm
- Visible Surface - Exterior 60mm
- Allowable slop 5 a' 45 degree
- Module Type Double glazed laminate crystalline/amorphous

Lexicon cuts & Sections

Integration Of Solar Energy In Envelope (Roofs)

Uni-solar photovoltaics modules are applied on insulating panels

Self supporting Insulated Photovoltaics on Pitched roof

Selft supporting Insulated Photovoltaics on Pitched roof

( side Profile)

(Front profile)

Photovoltaic Integrated Curtain wall on South Facade

curtain wall is a thermal insulation facade - integrated on South facade of Vin Gomfi hat.
The structure is composed of 52 mm wide tubular Mullions and Transoms.
Rabbet expanders are added to mullions and transoms to integrate junction box of photovoltaic panels.
These expanders are used with armourers and caps of 88 mm, especially adapted which allow to conceal cables.

Proposed Photovoltaic cutain wall on south facade

Sectional Plan (Partial)

Partial view of Curtain wall with Current flow wires
There is complete alignment of the two columns for an even transfer of load. The ends are machined for proper load transfer. The attaching plates arrive on the job site bolted to the lower column. The plates at the sides are bolted on to attach the two column sections together.

Vertical bracing/Stiffness of added columns

Here an intermediate plate transfers the load from column to column (the flanges do not align). Additional plates are used on the sides at the flanges as permanent shims to allow the most exterior plate to align.

Central Raised Roof Structure

Central Structure Stiffness

Raised Structure/Transverse Section

Raised Structure/Longitudinal Section

Column Splices for same size

Splices for the columns -not the same size
The Energy use include:
- Air Conditioning
- Building Internal Lighting
- Building Internal Plug Loads
- Common Area Lighting and Power

Building Energy Requirements:

<table>
<thead>
<tr>
<th>Building</th>
<th>Energy Requirement</th>
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</thead>
<tbody>
<tr>
<td>Conference (12°C)</td>
<td>365,627 kWh/year or 166,972 watt</td>
</tr>
<tr>
<td>Offices (22°C)</td>
<td>314,670 kWh/year or 52,222 watt</td>
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<tr>
<td>Offices on 6/7 (27°C)</td>
<td>1,242,215 kWh/year or 330,670 watt</td>
</tr>
<tr>
<td>Etc. (18°C)</td>
<td>1,235,136 kWh/year or 342,311 watt</td>
</tr>
<tr>
<td>Total</td>
<td>3,050,951 kWh/year or 797,706 watt</td>
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</tbody>
</table>

Note: The Energy use include:
- Air Conditioning
- Building Internal Lighting
- Building Internal Plug Loads
- Common Area Lighting and Power

With:
- good insulation
- Day light
- Ventilation
- Radiant floor

The building need > 797.0 kWh/year

Total electricity produced by building envelope: 305037 kWh/year

The red will go to local Grid used for the days without sun.
The main Energy target of the project was to demonstrate that the concept of a zero-energy building is possible even in the Heritage building.

**Energy Production**

**Passive Tech. Internal Climate**

**Passive Strategies**

**Well-insulated, airtight envelope:**
- The envelope is made to comply with Passive building standard in terms of heat loss from transmission, infiltration and normalized thermal bridge values.
- U-value for walls: 0.15 W/m²K
- U-value for glass: 0.60 W/m²K

**Linear open spaces:**
- The corridors are avoided to minimize the circulation area.
- The open spaces are used to promote day lighting and cross ventilation.

**Other passive strategies**

**Radiant and Concrete floor**

**Radiant floor**
- With good insulation
- Day light
- Ventilation
- Radiant floor

The building needs 797.0 KWh/year