The Sino-Italy Environment & Energy Building (SIEEB) is an intelligent, ecological and energy-efficient building: a model for a new generation of sustainable buildings.

Function: education, office and research
Site: Tsinghua University campus
Site area: 3,640 m²
Building area: 20,000 m²
Building height: 40 m
Features

• high energy efficiency
• renewable energy use
• low CO\textsubscript{2} emissions
• resources saving including construction materials
• minimum environmental impact in construction and use
• intelligent control during operation and maintenance
• healthy indoor air
• environmentally sound and durable materials
• water recycling and re-use
The site
### Project

**Building Design**

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project leader:</td>
<td>Federico Butera, BEST</td>
</tr>
<tr>
<td>Architectural Design:</td>
<td>MCA Mario Cucinella Architects</td>
</tr>
<tr>
<td>Ettore Zambelli, BEST</td>
<td></td>
</tr>
<tr>
<td>Engineering:</td>
<td>China Architecture Design &amp; Research Group</td>
</tr>
<tr>
<td></td>
<td>Favero &amp; Milan Ingegneria</td>
</tr>
</tbody>
</table>
BEST Work Team

<table>
<thead>
<tr>
<th>Building simulation:</th>
<th>S. Ferrari, U. Beneventano</th>
</tr>
</thead>
<tbody>
<tr>
<td>Envelope technologies:</td>
<td>N. Aste (Dipartimento di Energetica)</td>
</tr>
<tr>
<td>HVAC simulation:</td>
<td>P. Oliaro, R. Adhikari</td>
</tr>
<tr>
<td>Energy analysis:</td>
<td>P. Caputo</td>
</tr>
</tbody>
</table>

In collaboration with Tsinghua University
Consultants

Advanced Engineering
energy systems

AIACE S.r.l.
architectural design

Dipartimento di Energetica, Politecnico di Milano
daylighting, PV systems

ENEA
control systems

PERMASTEELISA
envelope technologies

Studio Finzi
structures
Design Methodology
Beijing climate analysis

Solar radiation: high in summer

Winter: very cold

Summer: very hot and humid
Shape analysis
Shadows (21st March)

Shadows analysis

21 Dec. 11:00
21 Dec. 12:00
21 Dec. 13:00

21 July, 11:00
21 July, 12:00
21 July, 13:00

Shadows (21st March)

ore 7.00
ore 9.00
ore 12.00

ore 14.00
ore 16.00
ore 17.00
Shapes comparison criteria:
- max solar energy in winter
- min solar energy in summer

The best shape
First design stage
Computer simulations

- Heating: 22%
- Cooling: 42%
- Lighting & Equip.: 36%
- Lighting: 34%
- Equipment: 21%
- Ventil. fans: 13%
- Miscell.: 8%
- Fuel: 22%

Electricity: 78%
Needs

• reduce heating and cooling load
• minimise electricity consumption due to artificial lighting
• minimise the electricity demand of the HVAC system
• cover as much as possible the electricity demand of the building by means of cleaner production systems
Reduction of heating and cooling load

- low U value for walls and glazing
- mobile louvers for enhancing solar gains in winter and solar protections in summer
Enhancement of natural lighting
Enhancement of natural lighting

Combined with high efficiency artificial lighting systems
Daylighting devices

Lightshelf

Lamellas
Reduction of electricity demand from pumps and fans

Radiant ceilings and displacement ventilation
Strategies adopted

Sun control & natural lighting

Displacement ventilation & radiant ceilings

High efficiency artificial lighting & dimming
Electric grid

Compression chiller

Boiler

Electric uses

Base Case (conventional)
Electric grid

Compression chiller

Boiler

Improved (all strategies)
Reduction of energy demand

- Cooling
- Heating
- Lighting & Equip.
Primary energy consumption

[Bar chart showing primary energy consumption for Base case and Optimised scenarios, with MWh on the y-axis and Base case vs Optimised on the x-axis.]
Architecture
Semi-reflecting glass louvers

Winter Sunny day

Summer Sunny day

Summer and winter overcast day
Perforated reflecting lamellas

Winter
Sunny day

Summer
Sunny day

Summer and winter
overcast day
Compared with current building design, SIEEB can save more than 1,000 tons of CO$_2$ per year.