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6 Key Guidelines for Energy-Efficient Building Design

What is the Solar Village?

Solar Village is an educational and research project that investigates how shading systems and building orientation influence indoor temperature and energy efficiency. Small insulated cubes equipped with temperature sensors were built in several European countries. Each cube represents a different combination of shading and orientation (north, south, east, west). The sensors measure temperature and send the data to an online platform, allowing students and researchers to analyse how shading affects heat flow in buildings. The measurements clearly show that simple design decisions can significantly improve energy efficiency.

1. Use External Shading in Summer

External shading is the most effective way to prevent overheating of indoor spaces during summer.

Measurements from the Solar Village experiment show that external shading can reduce solar heat gains through windows by more than 80% compared with unshaded glazing.

Typical external shading solutions include:

- pergolas or shading structures above terraces
- shutters or folding wooden panels (polkna)
- roller shutters
- external blinds or louvers
- roof overhangs.

These elements prevent solar radiation from reaching the glass surface and therefore significantly reduce heat entering the building.

Illustrations of typical shading systems such as pergolas, shutters, blinds and roller shutters should be included to help readers understand these solutions.

2. Consider Building Orientation

Building orientation plays a very important role in solar exposure.
General observations include:
South façades receive the strongest sun at midday. However, in summer the sun is very high in the sky, which means that properly designed roof overhangs or small shading elements can effectively block direct solar radiation. In winter the sun is lower, which allows solar radiation to enter through south-facing windows and contribute to natural heating.
West façades receive strong solar radiation in the afternoon during summer and are therefore one of the main causes of overheating.
North façades usually receive the least direct sunlight.
Because of this, window size and shading should be carefully adapted to each orientation.

3. Adjust Shading According to the Season

Shading should be used differently in summer and winter.

Summer

- keep external shading **closed during the day**
- open shading **during the night** to allow cooling.

Winter

- keep shading **open during the day** to allow solar heating
- use **internal blinds or curtains at night** to reduce heat loss.

This seasonal strategy helps maintain comfort while reducing energy consumption.

4. Protect Windows – They Are the Weakest Thermal Point

Measurements from the Solar Village experiment show that most heat transfer occurs through windows rather than through insulated walls.
Because of this, window design and placement are very important.
Large glazed surfaces should preferably be placed on the south side of the building, where solar radiation can be beneficial during winter and can be controlled with simple shading in summer.
Only small shading elements or roof overhangs are usually sufficient to protect south-facing windows during summer.
Large windows should be avoided on east and especially on west façades because these orientations are exposed to strong low-angle solar radiation during the morning and afternoon, which can easily cause overheating.
Regarding glazing quality, double glazing represents a good price-performance balance for most buildings.

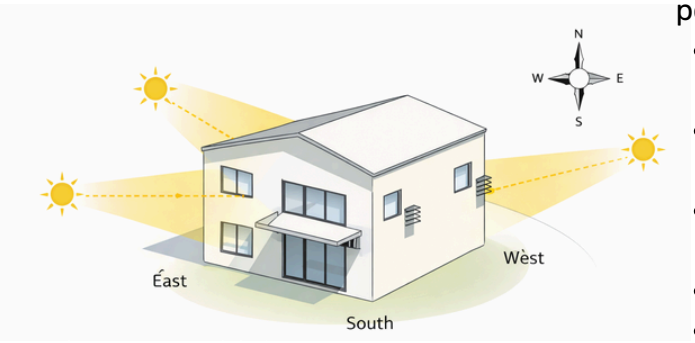
5. Combine Passive Design Strategies

The Solar Village experiment confirms that simple passive design strategies can significantly improve building energy efficiency.
Key strategies include:

- proper window orientation, with the largest windows placed on the south side
- smaller windows on east and west façades
- good thermal insulation of building walls (for Mediterranean climates at least 5 cm of insulation, preferably around 8 cm)
- avoiding excessive insulation thickness beyond approximately 12 cm, since the additional energy savings become very small
- use of double-glazed windows as a cost-effective solution
- external shading on façades exposed to direct sunlight
- natural ventilation and, if necessary, fan ventilation in closed rooms.

If a room becomes overheated, natural ventilation should be used first. If needed, fan ventilation can help remove excess heat.

6. Simple Solutions Can Have a large Impact



By applying common sense and basic design principles it is possible to:

- reduce overheating in summer with simple and affordable shading solutions
- reduce heat loss in winter with good insulation and moderate window sizes
- improve indoor comfort without expensive high-tech systems
- lower energy consumption both in summer and winter
- reduce environmental impact by limiting the need for air-conditioning.

The Solar Village experiment demonstrates that simple, affordable and easy-to-maintain design solutions can have a significant impact on sustainable living.