Promotion of Eco-building Technologies, small Polygeneration and Renewable Heating & Cooling Technologies for Buildings

ProEcoPolyNet Technology Profile

Sun Shading Devices

Concept description

The architectural concept for modern office buildings is dominated by glazed façades. How-ever, glazing elements of façades become more advanced in recent years. But in many cases the control of solar radiation requires the use of some type of window protection, which has basically the purpose of:

► reduce incoming radiation from the sun to avoid an increase of both air temperature and mean radiant temperature

► control the amount of daylight entering the building, with the general objective of admitting only indirect light, while blocking direct light.

► avoid glare effects.

Shading devices may be classified according to their operability, positioning, capability to face and follow sun direction (moveable or not), and to their feasibility.

Implementation of technology

There are two main application approaches:

► Solar control and overheating prevention, (better external positioning)

► Glare prevention and daylight use strategies (both internal and external types)

The choice of the designers should take into consideration the local and specific conditions to deal with as well as the available technologies.

Physically, we can classify window shading device in order of their thermal interaction with glazing which depend on their positioning, external or internal, and in order of their capability to face and follow sun direction, moveable or not.

Hereafter, the main shading devices are listed:

► Moveable devices
- o Internal blinds
- o External blinds
- o Blinds between two layers of glass
- o Awnings or movable fins

► Permanent devices
- o Overhangs
- o Vertical protections - fins
- o Louvres
- o Lightshelves

Overhangs and horizontal devices are suitable mainly for south facades, vertical mainly for east and west walls.

It is worth saying that in the southern European climate, the direct solar radiation is very high in relation of the rest of Europe, the sky is more uniformly bright and there is significant illumination from ground reflectance. Overhangs are particularly favoured in these areas. This fact can be illustrated by many traditional solutions in the southern parts of Europe like the recessed windows in thick walls that are in effect provided with both overhangs and side-fins. However, they include also moveable louvred screens.

Care must be taken at the material selection of shading devices: Those made of heat absorbing and not reflective materials might create a heat bridge to the building.

Performance

The effectiveness of the window/façade system, as for glazing systems, is expressed in terms of Solar factor (g-value, also SHGF, Solar Heat Gain Factor) or in terms of Shading Coefficient, S.C.

The Shading Coefficient is conventionally defined as the rate of the window system solar factor, gsys (already defined in glazing sheet), to the reference solar factor of a single 3mm clear glass, gref (gref = 0.89).

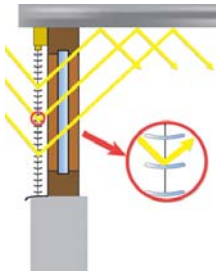
S.C. = gsys / gref

Energy and economic benefit

Sun shading devices have two main benefits:

► Lower cooling loads due to direct solar radiation, which means lower energy costs and better thermal comfort.

► Allow daylight use strategies and visual comfort control (see figure)



Solar shading devices play a decisive role in energy conservation and comfort performance in cooling dominated climates and summer seasons. In addition, they give energy benefits in winter time and in heating dominated climates.

In summer, solar radiation through transparent façade in fully glazed office buildings may be responsible may be responsible for 70% of the peak cooling load. An external shading system with a shading coefficient of 10-15% may drastically reduce this load, while still allowing some daylight to get into the building from diffused and redirected radiation. Applying efficient movable shading systems with automatic regulations, cooling demand could be decreased up to 70 percent in comparison to buildings without any shading devices.

In winter, moveable devices permit visual control and better use of daylight and solar heat gains avoiding glare effects. Glare sometimes forces users to completely obscure the window and turn on electric lighting. In these cases, the adoption of indoor Venetian blinds or white diffusing tends may have energy and comfort benefits both on lighting and heating demands.

Typical cost indicator (relative to a conventioal HVAC system)

- ► Operating costs – low
- ► Operating maintenance costs – low-medium
- ► Investment costs – medium-high

Obstacles

Even if external shadings are always more effective in overheating prevention, they generally have great impact on the exterior appearance of the façade. In some cases, architectural conservation may restrict their application.

Benefits

The adoption of internal or external sun shading devices are often the only way to prevent from glare effects on desks an monitors, that may cause strong restrictions in the use of the spaces which are very close to the windows.

Moreover external shading devices reduce the glazing internal size temperature when sun radiation hits the window and this also reduces local thermal discomfort near the windows.

External shading devices are influencing the architectural concept of a building. By integrating this system in the façade and architectural concept in an early planning stage, shading sys-tems can be a essential part of the appearance of a building (see figures below).

Contact and further information

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Date of release of this Best Practice Sheet:
Juni 2007

ProEcoPolyNet is a **Net**work for the **Pro**motion of RTD results in the field of **Eco**-building technologies, small **Poly**generation and renewable heating and cooling technologies for buildings.
The Consortium consists of the following partners.

The ProEcoPolyNet project is supported by

SIXTH FRAMEWORK PROGRAMME