Solar protection plays a major role in the overall energy balance

ES-SO identifies the potential of modern systems

The buildings sector in the 25 member states is altogether responsible for over 40 per cent of the total primary energy consumption in the EU. Experts assume that consumption can be lowered by at least one fifth by applying improved technology.
Photo: Roland Halbe

ES-SO, the umbrella organisation of European roller shutter and solar shading organisations, (European Solar Shading Organisation) has set itself the target of giving the public a greater understanding of roller shutter and solar shading products and of clearly emphasising their positive effects on energy consumption.

The European authorities – Parliament, Commission and Council of Ministers – have also long-since dealt with energy-related topics. Buildings are especially regarded as an important source of saving energy – and not without reason. The buildings sector in the 25 member states is altogether responsible for over 40 per cent of the total primary energy consumption in the EU. Experts assume that consumption can be lowered by at least one fifth by applying improved technology. This is therefore the main topic of the European directive No. 2002/91/EU, with which the energy performance of buildings is controlled. This was published at the beginning of 2003 and came into force in Europe on 04.01.2006.

Europe is strongly dependent on oil imports. In 2030 this dependency will have increased to 70% if no adequate measures are taken. The European directive therefore assumes the following principle: „If we can't significantly influence supply then we should at least influence demand". Environmental aspects – how can the union carry out its Kyoto obligations? - take precedence. Two other priorities are, however, also laid down in the text of the directive: The secured supply of energy (strategic) and competitiveness (economic).

As a result, the leitmotiv of the EU directive therefore has to be "Save Energy!" The European Parliament and the Council of Ministers assume the following facts:

- The building sector amounts for 40 per cent of the total energy consumption in the EU.
- Production of energy is the largest source of CO^2.
- The energy savings potential in buildings by 2010 will amount to approx. 22 per cent.

This agenda therefore focuses on the following:

- A binding, integrated approach for the evaluation of energy in buildings.
- Specification of national energy minimum standards in new buildings.
- Specification of standards in buildings sector (buildings >1,000 m^2 and with appropriate scope for modernisation).
- Step-by-step introduction of an energy passport - also in the buildings sector
- Energy passports from public buildings have to be presented.

Energy passports in the member states will be passed on to their national authorities. The amendment of the EnEV (energy saving regulation) and new technical rules for various sectors such as building envelopes, heating, ventilation or energy recovery are part of the realisation of the directive in Germany.

Solar shading is also explicitly mentioned in the text of the directive together with passive solar systems. But there's a whole lot more, too. Solar protection can, when correctly controlled, provide a contribution to the

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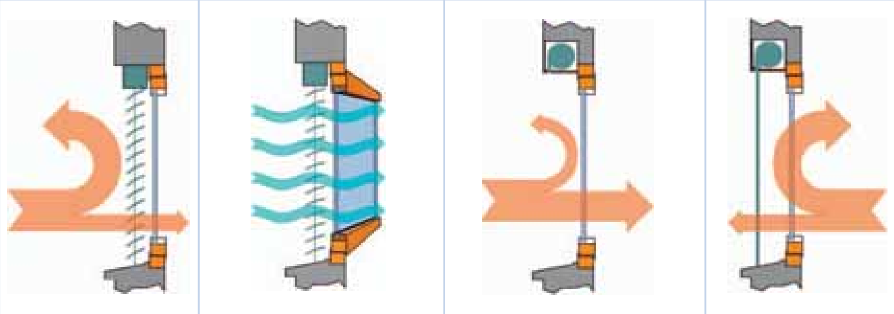
Photo: H. G. Esch



During the daytime in the summer: Heat insulation. "Dynamised" solar protection provides a clear contribution on the aspects of the directive when correctly controlled, because the energy consumption of air-conditioning units can be greatly reduced or completely cut out by this.

During the night time in the summer: When the building cools down in the night due to natural ventilation, heat that has stored itself in the building during the day is dissipated. That means less energy consumption for the air-conditioning the next day. The diagram shows an open window through which ventilation during the night is facilitated.

During the daytime in the winter: Intelligently controlled solar protection lets in free solar energy, which is added to energy consumption during the heating period. The diagram shows a vertical system in a rolled-up position. The glass will reflect a part of the solar energy, but let a great deal through.

During the night time in the winter: Solar protection (or roller shutters) is operated to go down and thus improves the u-value (heat transfer co-efficient) of the window. Result: somewhat less energy for heating.

Images: ES-SO

other aspects of the directive. Solar protection "dynamises" the static properties of glass.

- Solar protection prevents overheating in the summer. Thus the energy consumption of air-conditioning units is greatly reduced or completely cut out.
- In the winter an intelligently controlled solar protection system will direct free solar energy into the room and thus lower the energy costs for heating.
- External and internal solar protection systems can contribute to optimum daylight utilisation and thus result in lower energy consumption when using artificial light.
- Solar protection has a verifiably positive influence on the indoor temperature. Comfort and work performance clearly improves if solar protection has been well planned.
- It shouldn't be forgotten that solar protection falls under the directive on Safety and Health for Work with Display Screen Equipment.

The European Commission has made the topic of energy one of its main priorities and taken the initiative publishing the „Green Paper on Energy Efficiency or Doing More With Less" in June 2005. Reading this paper, it could be seen that not only environmental aspects and the question of greenhouse gases were among the main themes, but also the question of competitiveness in our industry (less energy consumption would lower costs) and the secured supply of energy.

This is also understandable, because glass facades are everywhere around us. They represent aesthetics, modern design, transparency and openness. But how comfortable are they really for the residents or for the employees in offices? Without modern solar protection systems – not at all, really. Because even though the glazing of the facade may be of the best quality, it remains static. And nothing changes as quickly and abruptly as the weather. The brightness can fall from 100,000 to 10,000 lux in seconds, just because the intensity of the irradiation dramatically changes during these short time periods. Only an intelligent, mobile solar protection system can be of help.

It has to be asked what the significant features of modern solar protection systems are.

- The values of energy transmission and reflection.
- The g-value calculated from these results or the total degree of energy transmission
- Light transmission in the area of visible light.
- The u-value or thermal transfer factor.
- Sometimes also the "openness factor", i.e. the transparency of the textile solar protection fabric.

A typical g-value for external solar protection lies between 0.10 and 0.15. This actually means that 85 – 90 per cent of solar energy is withheld. The result is, of course, much lower when using internal solar protection. The solar energy permeates the room even before reaching the solar protection system. That's why g-values of 0.35 – 0.65 are normal for internal solar protection systems, whereby the figures can vary depending on type and version. And there is naturally an improvement in the u-value of the window due to the solar protection system. Measuring tests at the WTCP in Belgium (a research institution, which is comparable to the Fraunhofer Institutes in Germany) have shown that the u-value of a reference window (u = 1.70 W/m^{2}K) improved to 1.55 W/m^{2}K when using an external vertical system, and to 1.60 W/m^{2}K when using internal solar protection.

When the g-value is expressed as a percentage of the solar energy, then we have to ask how much energy we are actually talking about. It's a great deal. In Western Europe approx. 150 kW hours per m^2(kWh/m^2) were accrued in July alone. Over the whole year this value would amount to approx. 1,000 kWh/m^2. If this energy could be used sensibly our energy crisis would soon be solved.

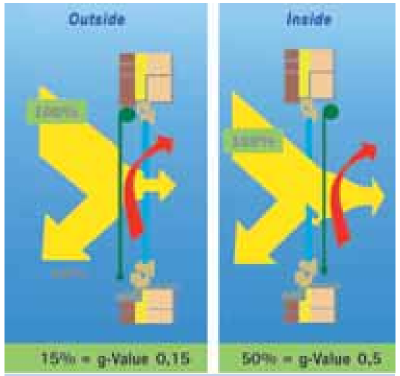
In the winter solar protection also contributes to the improvement of room temperature and energy saving. The important role of intelligent control becomes especially visible in this case.

Quality and the controls of solar protection systems have an especially great influence on energy requirements in full glass facades. Tests have repeatedly shown that the effectiveness of solar protection can be increased when combined with natural ventilation. The thermal building mass is thus cooled down and the morning room temperature is lowered in the summer.

It is a new thing to measure the performance of a building. We are used to recognising, calculating and evaluating performance. We don't ever buy a car without knowing the exact facts and figures. Every mobile phone is supplied with a thick instruction pack. But many things are unclear if we plan to buy a building. This directive wants to change all this. We should know the energy consumption in advance – even if it depends greatly on individual

How is the g-value calculated?

In the summer setting – and with that you basically identify solar protection, even though it also provides an important contribution during the other seasons – it's about preventing overheating by reflection and low transmission of solar protection. The solar energy is partially let through. This part is measured according to the energy transmission factor (Te), while the reflected part of solar energy is measured according to the reflection value (Re). The absorbed part (Ae) is the balance, because Te + Re + Ae = 100. The three units are expressed as a fraction (i.e. 0.15) or as a percentage (i.e. 15%). They are measured in a spectrophotometer by means of a small piece of solar protection fabric. The g-value is calculated on the basis of these measurements, according to a standardised calculation formula (EN 13363). This g-value is the correct criterion for the effectiveness of a solar protection system. Expressed as a fraction or a percentage it states how much of the solar energy finally enters the building.



Typical measuring values for the energy balance with an internal and external solar protection system.

residents and their personal energy habits.

Building simulation programmes are becoming increasingly important in order to be able to calculate how a building reacts to climatic data (i.e. sun and cold) during the early project stage. There are various planning tools and software solutions for this purpose. Of course, the values of transmission and reflection of solar protection systems (i.e. textile or slats), as measured according to the new EU norms, are essential. The climatic data as well as the characteristics of the building then result in the advance calculation of the temperature in the building. Similarly, the energy requirements when using climate control units – preferably with or without solar protection, with various solar protection types or fabric colours in order to facilitate an intelligent choice. In many cases it then stands out that no – or only small – air-conditioning units are required in Central and Northern Europe. The reduction in the cooling load enables 30 – 50 per cent savings in energy.

Optimum daylight utilisation and cover panel protection are top issues of the day - for many reasons. Artificial light is usually energy-inefficient. A simple bulb is unwanted electrical heating. Only five to ten per cent of the energy consumed is possibly realised in viable lumens. Using daylight is therefore a simple source of saving energy. But there's a whole lot more. Light and visibility are psychological needs. Our body clock is determined by daylight.

Great demands are made on daylight in connection with workplaces with PC screens. This is where planners and property operating companies are still often under the common misinterpretation that "Room lighting with natural daylight can result in extremely high solar gains – and thus overheating -, but because solar protection utilisation can also lead to darkening, this once again requires the use of artificial light". This is not necessarily true though. The solar protection branch offers many cleverly thought-out systems whereby the one feature can be attained and the other prevented.

Simulations can be carried out in order to determine what happens with the lighting conditions. Software programmes like Radiance enable both the brightness Lux (lx) and the LED to be defined and the perceivable brightness to be calculated in Candela (cd) per m²(cd/m²). When the visible light transmission is recognised (Tv) for a specific shading solution, calculations can be made showing how both are influenced by this and whether the conditions for visual comfort have been attained.

Solar protection - explicitly mentioned

Literal extract from the text of the directive:
General framework for the calculation of the energy performance of buildings (Article 3):

1. The methodology of calculation of the energy performance of buildings includes at least the following aspects:

a) thermal characteristics of the building (shell and internal partitions). These characteristics may also include air-tightness,
b) heating installation and hot water supply, including their insulation characteristics;
c) air-conditioning,
d) ventilation;
e) built-in lighting installation (mainly the non-residential sector);
f) position and orientation of the building, including outdoor climate;
g) passive solar systems and solar protection;
h) natural ventilation,
i) indoor climatic conditions, including the designed indoor climate.

2. The positive influence of the following aspects shall, where relevant in this calculation, be taken into account:

a) active solar systems and other heating and electricity systems based on renewable energy sources;
b) electricity produced by CHP;
c) district or block heating and cooling systems;
d) natural lighting.

3. For the purpose of this calculation buildings should be adequately classified into categories such as:

a) single-family houses of different types;
b) apartment blocks;
c) offices;
d) education buildings;
e) hospitals;
f) hotels and restaurants;
g) sports facilities;
h) wholesale and retail trade services buildings;
i) other types of energy-consuming buildings.

It is the task of the 25 EU member states to integrate the directive on energy efficiency in buildings into national laws and ordinances. Countries have both the obligation to take up these measures and to communicate this topic to others.

Germany has therefore already amended the existing energy saving regulation EnEV and France has revised the RT 2000 to RT 2005 in order to meet the new information provided. Many nations have published new guidelines, whereby lots of changes will be made – and this has already had an effect on construction inquiries. It is unclear as to whether all nations have already put into practice this directive. One thing is sure, however, that the commission in Brussels will insist on execution of the directive.

The planners have more influence in the new EnEV. The new, binding overall approach for the evaluation of energy in buildings demands that all energy consumption sources as well as the causes of the actual loss of energy are taken into consideration: heat insulation, heating and hot water generation, ventilation, lighting, solar protection, air-conditioning, location and orientation of the building – with reference to renewable energies and combined heat and power generation. The inflow of solar energy through glass surfaces can be exactly calculated together with the adequate climatic data. And that's exactly where the positive influence of modern solar protection systems can be seen.

In summary it can be ascertained that the European directive on the energy performance of buildings in EU states presents the obligation to take measures in order to boost the savings potential of energy (22 per cent by 2010). It demands that every possible source is tested for its economic benefits.

The external climate has a strong variable influence on a building, no matter whether it is a home or office building. The quantity of light, as well as the quantity of solar energy, can change from a factor of 3 to 10 in just a few minutes. Mobile solar protection is the solution. The parameters from the point of view of construction physics on the definition of solar protection are known. The measuring methods are standardised. Stimulation programmes enable the effects to be reliably determined in advance. The market offers affordable and easy-to-use controls in order to optimise the effects.

That's why ES-SO has started a trial project in order to quantify the energy savings potential gained by solar protection and thus the potential of reducing greenhouse gases throughout Europe. This project will be completed shortly and make a strong case for recognising solar protection as an important construction element, which can have a significant contribution to attaining the objectives of the European directive for improved energy efficiency in buildings.

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