THE IMPORTANCE OF SOLAR SHADING IN THE DESIGN OF AIR-CONDITIONING SYSTEMS IN NEW BUILDINGS

Summary

- ✓ Shading should be considered as part of the building services package
- ✓ Highly glazed buildings like the Shard can still comply with the energy saving needs of the Building Regulations if efficient shading is installed
- ✓ A holistic approach is required to achieve comfortable and energy efficient new buildings
- ✓ A correctly specified solar shading system can significantly reduce investment costs and running costs of HVAC systems

1.0 INTRODUCTION

"Selection of solar shading should always be one of the first steps in the design of HVAC systems (Heating Ventilation and Air-Conditioning) as the demand for power and the energy consumption are greatly affected by solar shading."

(Olli Seppänen, Secretary General, REHVA)

This guidance note demonstrates how correctly specified solar shading will deliver significant benefits by reducing both capital costs and energy running costs of HVAC systems. Blinds and shutters are not just the remit of interior design, they save money and provide more comfortable glare free interior environment for the buildings' occupants. This guidance note looks closely at the new build as the costs and benefits of solar shading will be different to that of a retrofit with an existing air-conditioning system (for retrofit see BBSA Guidance Note S-21A).

Solar shading should ideally be planned at the design stage as the systems within the building interact with one another and a holistic approach is essential to achieve the best results. A design benefitting one aspect of HVAC, lighting, glazing or shading system could have a negative impact on a different system and balancing these will deliver the desired effect.

2.0 SOLAR SHADING & ANALYSIS OF COST BENEFITS

The Federation of European Heating, Ventilation and Air-Conditioning Associations (REHVA) together with the European Solar Shading Organisation (ES-SO) considered a model office in three different European cities: Amsterdam, Stockholm and Madrid under two different scenarios:

1) Solar control glazing
2) Low-e glazing and automated external venetian blinds controlled by a seasonal programme

The table below shows a comparison of the two model scenarios under Amsterdam climate conditions as this city has similar weather conditions as parts of the UK.

Investment costs and running costs for both situations were set to maintain an internal temperature of 22°C and solar irradiance of maximum 200 W/m^2. The model was programmed to switch the artificial lighting off when lux levels exceed 500 lux.

AMSTERDAM	SOLAR CONTROL GLAZING			LOW-E GLAZING WITH SOLAR SHADING			
INVESTMENT COST	QUANTITY	UNIT	COST (€)	QUANTITY	UNIT	COST (€)	DIFFERENCE (€)
HVAC	1,490	W	1,729	1,053	W	1,423	306
SOLAR SHADING	6.48	m^2		6.48	m^2	626	- 626
GLAZING	6.48	m^2	791	6.48	m^2	441	350
TOTAL INVESTMENT			**2,519**			**2,490**	**30**
RECURRING COST							
LIGHTING	99	W	10	91	W	9	1
COOLING	404	m^2	20	292	m^2	14	6
HEATING	447	m^2	22	372	m^2	19	3
TOTAL RECURRING/ YEAR			**52**			**42**	
SIMPLE PAYBACK PERIOD (YEARS)							**0**

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The data shows that overall the payback period for the solar shading is less than a year. This is because the investment required for the shading is lower than the investment for the advanced solar control glazing and HVAC costs.

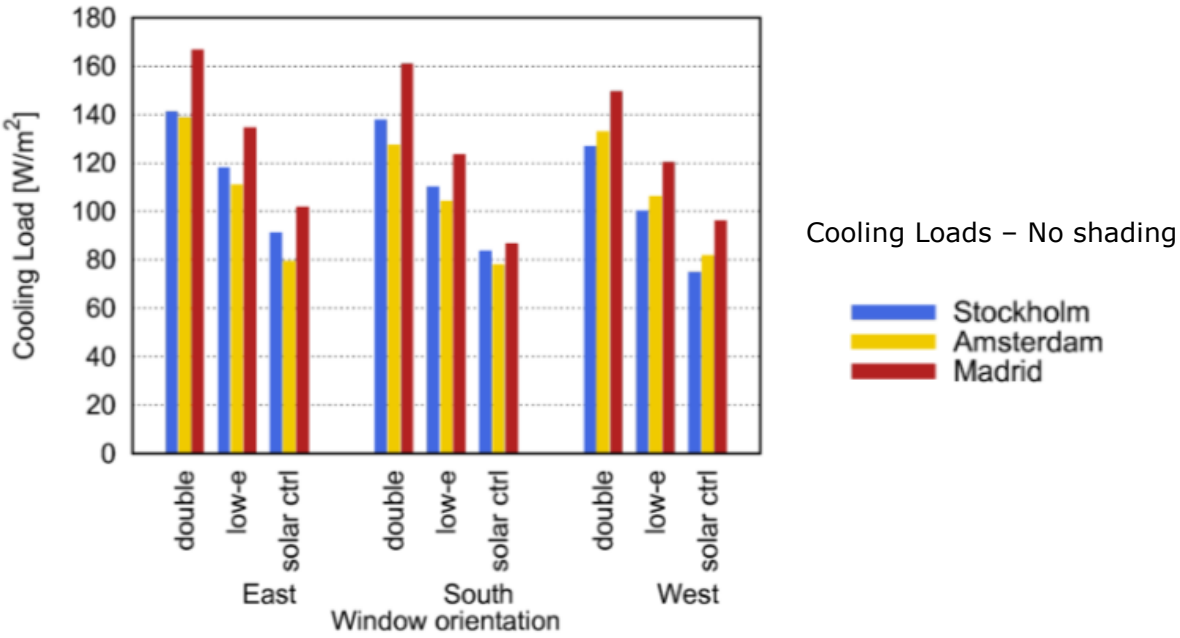
As can be seen, a significant benefit is achieved through a reduction in running costs (lighting, cooling and heating).

A reduction of 20% is also seen between an office with solar shading installed and an office without any shading.

The same tests were also carried out for Stockholm and Madrid climate conditions. Both of these cities also showed a payback of less than a year for the solar shading.

To see the data for Stockholm and Madrid visit:
http://www.rehva.eu/fileadmin/Promotional_material/PPTs/Nr_12_Solar_Shading.pdf

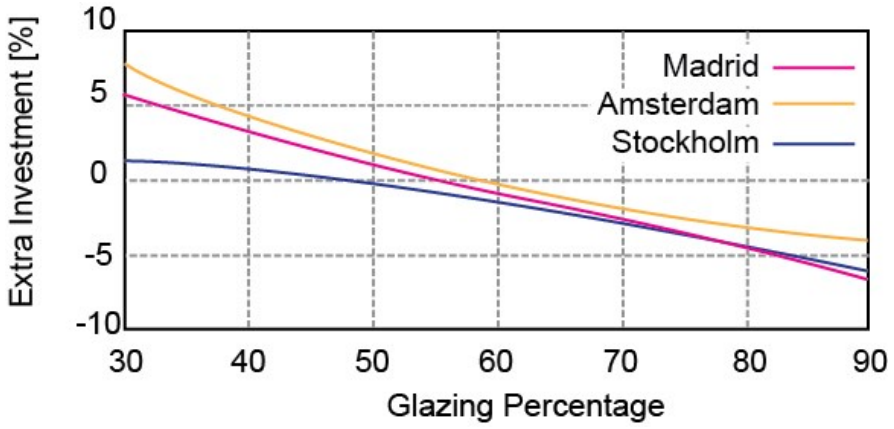
The computer modelling used an 18m^2 office with a glazing percentage of 60%. During the simulations, the maximum cooling load varied with the orientation of the building and its windows. The data below were based on average solar angles over the range from east to west.



Cooling Loads – No shading

3.0 SOLAR SHADING & INVESTMENT COSTS

This graph shows the amount of investment required to install shading compared to a base case of investment for HVAC and solar control glazing.



In general, when a building has a glazing percentage greater than 50-60%, it requires no extra investment for the installation of solar shading. This is because significant savings will be achieved through reduced running costs from lighting, cooling and heating and a smaller HVAC system can be specified saving additional capital investment.

4.0 FURTHER INFORMATION

REHVA Guidebook No 12. Solar Shading. How to integrate solar shading in sustainable buildings: http://www.rehva.eu/publications-and-resources/eshop/eshop.html?tt_products%5BbackPID%5D=6&tt_products%5Bproduct%5D=40&cHash=ca462aca78860f823f29daf4b8956391