Shading for housing

Design guide for a changing climate

Delivered by

Pollard Thomas Edwards with MAX FORDHAM, OXFORD BROOKES UNIVERSITY, MA MARTIN ARNOLD

Commissioned by

Good Homes Alliance, BBSA BRITISH BLIND & SHUTTER ASSOCIATION

Supported by

ballymore., Guthrie Douglas, LOUVOLITE, CARIBBEAN BLINDS UK LTD

“By the middle of the 2030s, 90% of the UK housing stock will suffer from overheating.”

Contents

The purpose of this guide is to forge a new design culture in which shading is central to housing design and built in from the start.

It is anchored by a detailed study of the best design-led shading products that architects can specify today.

The guide also provides a short history of shading design, explores UK-specific design challenges and wraps up with best practice advice.

Appendices cover product performance, and list additional resources.

Introduction

Until the turn of the 21st century, summertime in the UK was a decidedly cool affair. Hot ones were rare – 1976 stands out – and fondly remembered for years later. It's different now. In 2022, a temperature of 40.3°C was recorded in Lincolnshire. With global temperatures rising year on year – heatwaves are projected to increase in frequency, intensity, and duration[1].

Health hazard

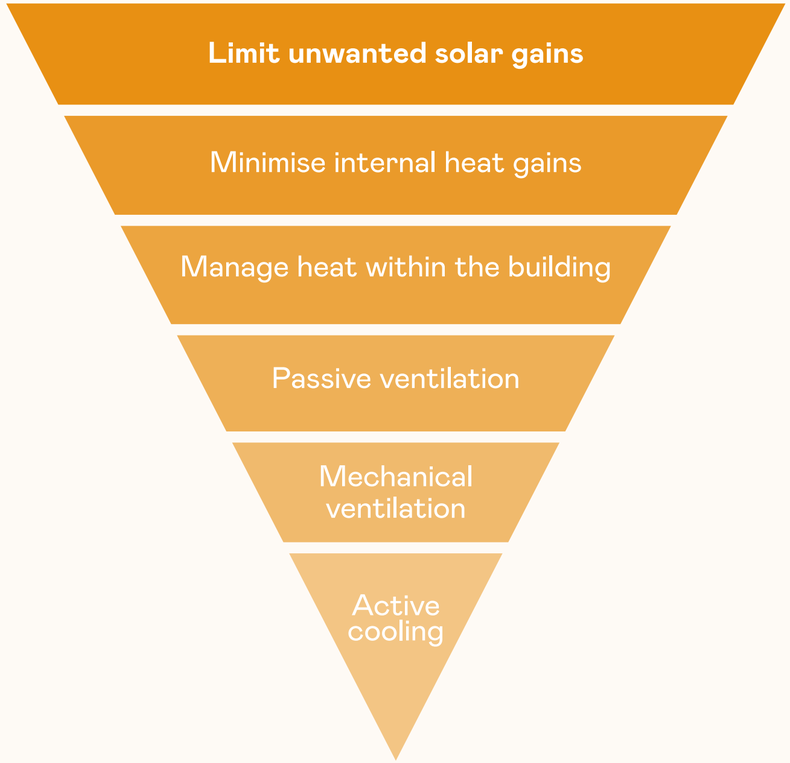
The threat is real: in 2020, according to the UK Health Security Agency, an additional 2,000 deaths were caused by heatwaves. In England's long hot summer of 2022 there were 4,500 excess deaths[2]. Under these conditions, too many British homes are seriously failing. A recent study[3] shows that by the middle of the 2030s, 90% of the UK housing stock will suffer from overheating. Simply put, our built environment – designed for dampness, breeze, rain and mild heat – is in no fit state to shelter us from this changing climate.

Forgotten art

The curious thing is, it wasn't always like this: even when our summers were not on red alert, our streets offered better solar shading than they do today. Indeed, from any time from the end of the 19th century until the 1950s, most British shopping streets had a layer of awnings floating above the shopfronts. Today however, shading devices – or products – for all kinds of buildings, but housing especially, are rarely made integral at design stage. In short, solar control is too often a tacked-on afterthought.

Barriers

There are several reasons for this, and barriers to shading in UK industry - spanning economic, cultural, technical and legislative sectors - remain. Too many stakeholders see shading products purely as a maintenance cost; a 'cold climate' outlook which considers shading products as superfluous still prevails, while open-ended legislation encourages smaller windows instead of proposing external shading products. For many, upfront cost is still a significant barrier, despite the mechanical ventilation and cooling savings that early shading design integration can bring. Health and safety guidance also nixes the use of shading products, especially on high-rise buildings.



Cooling hierarchy (adapted from GLA London Plan): an environmentally-friendly priority list when designing for overheating mitigation. Best practice would be dynamic and external shading to align with the cooling hierarchy.

A short history of shading design

For much of the 20th century, British city makers - planners, architects, developers and builders – were well-versed in shading design. Indeed, from the end of the 19th century and right up until the 1970s, British shopfronts used awnings to shelter potential customers from rain or shine. As the FT's architecture critic Edwin Heathcote notes, 'canvases span the space above the shoppers, creating a kind of soft-topped arcade, half-in, half-out; a generous gesture of protection (in an era when many stores had open frontages), spanning the street but also creating another surface for introducing advertising, information and colour. As we head into this summer, and the naked London streets bake in the sun, you can't help but feel the city is bereft.'

The history of shading devices for buildings in the UK, however, reaches further back than the Victorian era. Certainly, since medieval times, window shutters have had a role to play in domestic British architecture. Popularised during the Tudor period, shutters originally made from thick wooden boards were, in fact, commonplace in British homes before glass windows. Nevertheless, unlike vernacular architecture in hot climates, where shading was a significant driver in basic shelter design, in the British Isles, the cooler, wetter climate meant such devices were more often used to control privacy and daylight rather than the effects of solar heat.

We can assume, winding even further back, that British Romans would have used the technologies in use throughout their empire, like blinds – begun as pieces of damp cloth stretched across windows in Rome to keep dust out - which developed, over the years, into decorative and colourful fabric screens.

British Romans practiced passive solar building design too, capturing solar energy in cold seasons, blocking it in hot seasons, and maximising this cycle by locating buildings in reference to the sun's trajectory during different times of the year. Such methods stretch back thousands of years - Socrates was known to speak often about building orientation, size, and ventilation as key contributors to thermal comfort - with evidence in China suggesting passive building strategies were in play as long ago as 4000BC.

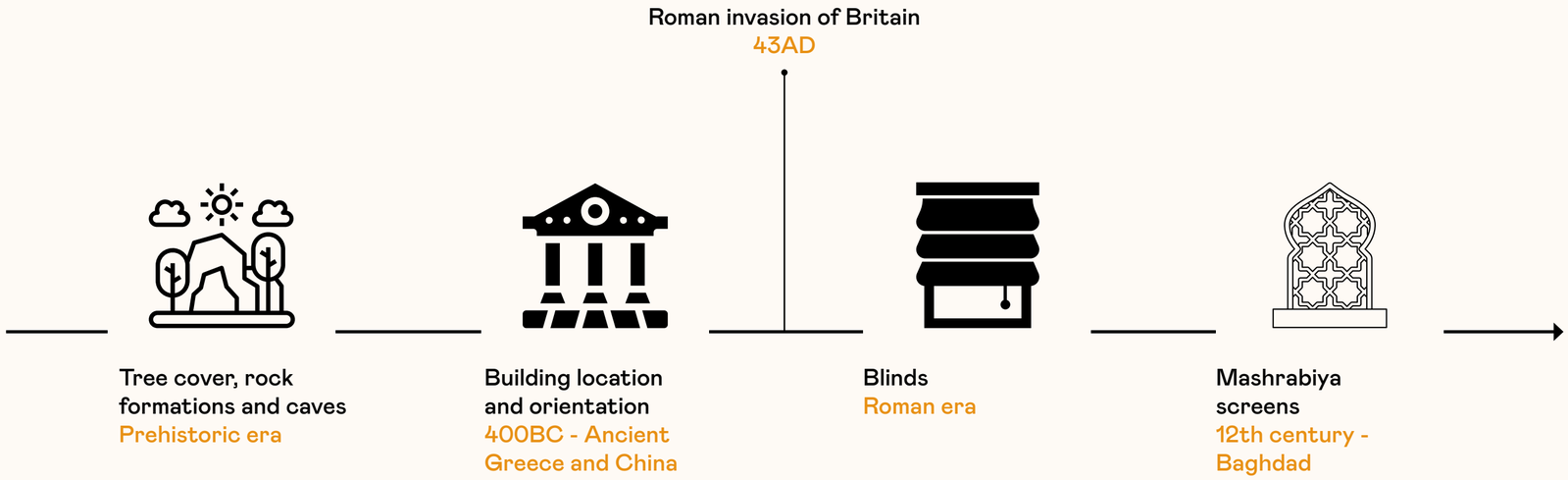
Buckingham Palace garden party, 1897, with all the window awnings down on the south-west elevation

A short history of shading design

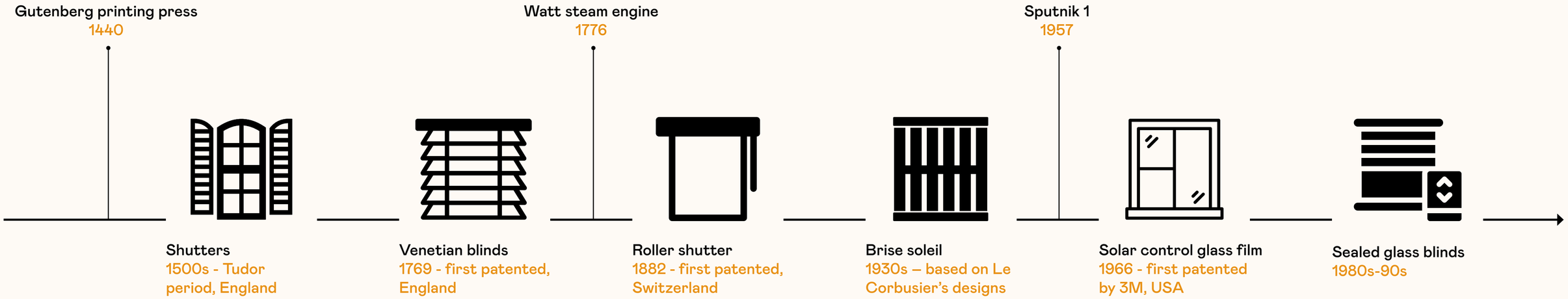
Despite a historically mild climate, Britain – the first country to industrialise - would go on to play a key role in shaping the fortunes of solar shading, when, in 1769, Englishman Edward Bevan patented the “Venetian Blind”. The device, commonly used in Venice, didn’t actually originate there – the French call them “Les Persienes”, given their common usage throughout the Middle East – spread rapidly throughout Europe and then the USA, as the Western world industrialised.

In the 20th century, industrialised processes wrought by Modernism transformed the production of architecture and urban design. Everything was made anew, even shading devices – when Le Corbusier re-invented the brise soleil for the modern age. These ‘sun breakers’ are just one in a large extended family of sun-shading products that, as the environmental cost of electrical air-conditioning has become clear, have become more prominent in recent years. Alongside solar control glass film these include elegant, horizontally sliding shutters, electrically operated blinds ‘that descend on the outside of the facade like slow guillotines’[4] and intricately pierced external blinds inspired by Arabic mashrabiya screens.

Indeed, it is somewhat ironic that it was the uptake of electrical air-conditioning in the postwar era that saw the built environment shorn of architectural shading devices that now, tentatively, are making a return. In this respect, slowly but surely, shading design in the UK is maturing. Unfortunately, we’re still seeing new homes built with shade-free floor to ceiling windows but there is also an understanding, for example, that solar film is not a stand-in for robust, externally fitted contemporary shading products.



A short history of shading design



Designing for shading best practice

This guide is calling for a new design culture in the UK. A design culture in which the everyday specification of shading products on domestic buildings – or the designing for shading from the start – is second nature among developers, housebuilders, architects and consultants.

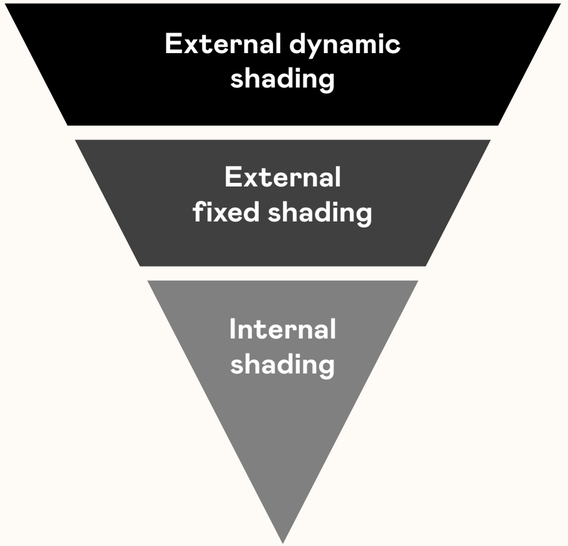
The public too, buyers and tenants alike, should be well-versed in the benefits that shading products bring, in terms of running costs, comfort and general wellbeing. Here, we present a shading 'cheat sheet' focused on the practicalities of adapting to holistic shading design.

Future proofing and climate resilience
As global temperatures continue to rise, so does the risk of buildings overheating. Currently buildings are not required to pass the overheating criteria using future weather files to comply with UK Building Regulations.

Modelling using predicted future weather data has shown that buildings designed with shading products built-in from the start are less likely to overheat in the future than those that aren't. Remember: futureproofing is cheaper than retrofitting. Incorporating shading products after a building has been built is always more costly than designing them in from the start.

Retrofit and change of use
In the course of a building's life, its fabric, services, even its function, can change – potentially leaving it prone to overheating. Improving the thermal performance of a building's fabric, for example, to reduce heating demand, will increase the risk of overheating on sunny days if no mitigation measures are incorporated. Specifying shading products when converting offices and other kinds of commercial property with large areas of glazing for residential use, will minimise the risk.

Dynamic versus fixed
Dynamic shading products are more effective at reducing the risk of overheating than fixed alternatives because residents can adjust them in response to seasonal weather changes. Furthermore, because of their inflexibility, some fixed products increase heating demand by blocking any solar gain during autumn or winter, for example. Dynamic shading products are not 'fit and forget' accessories: like any other mechanical equipment with moving parts, they must be included in a building's maintenance regime. Residents, who should be briefed on how their home's shading products work, will have a role to play, conducting visual inspections, for example, ensuring channels and guides are clear of dirt.



Shading device hierarchy (PTE, 2023)

Designing for shading best practice

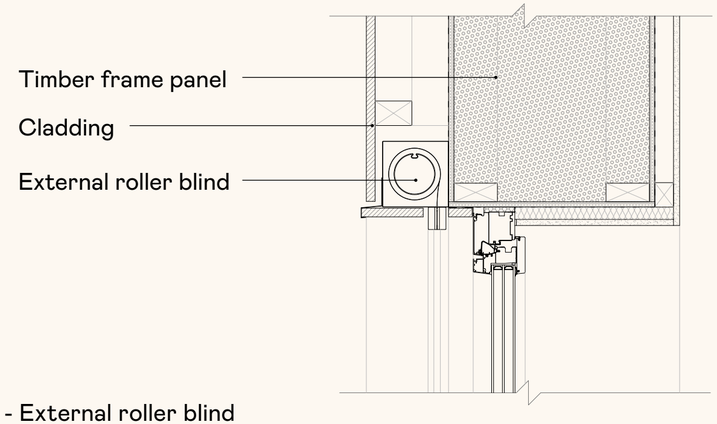
Internal versus external
Given the role external shading products play in the appearance of a building's façade, it is essential that they are designed-in from the start. Internal shading products are less effective at reducing overheating because they have to repel solar heat that has already entered the building and recent regulatory changes have excluded internal blinds from being used for overheating compliance in new build homes.

Windows
External shading products are less common in the UK compared to other countries, with most domestic windows opening outwards. This limits the selection of shading products available. As architects and housebuilders adapt to designing for shading from the outset, windows should open inwards, or slide up and down in traditional sash windows, to prevent clashing. In addition, inward opening windows allow for higher ventilation rates, are safer to operate, and easier to clean, leading to better daylight.

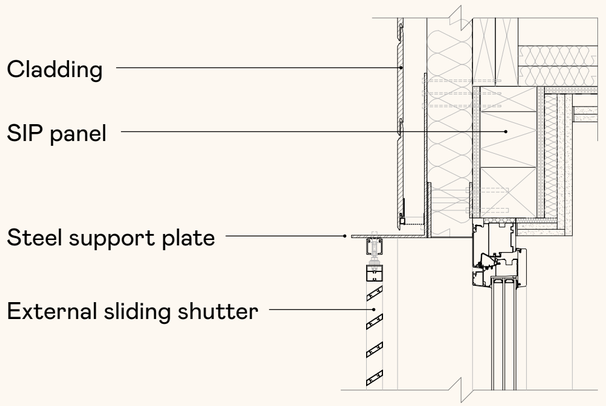
Technical considerations
Incorporating shading products into façades will always create new technical challenges, whether in structural support design, thermal bridging or combustibility, for example. Integral shading design means specifying shading products that are complementary to the construction method used.

Cost
The size and shape of windows significantly affect costs. Typically, for blinds or shutters, the base cost of both manufacture and installation means that, for larger openings, they become significantly cheaper per sqm of glazing. Whether a product is manually-controlled, motorised or automatic will impact upon cost. In short, the more sophisticated the control is, the more expensive the product will be.

Embodied carbon
Embodied carbon of shading products is small compared to the total embodied carbon of a typical new build, typically making up 1-2%. Furthermore, shading products can make significant reductions in ventilation and cooling demand with associated savings in operational and embodied carbon emissions.



Detail - External roller blind
(Adapted from The Deerings by Tye Architects/Gresford Architects)



Detail - External sliding shutter
(Adapted from Sulgrave Gardens by Cartwright Pickard)

Best practice examples of integrated shading design

Case studies - product guide

The product guide provides detailed information to help you select the right product for a building's shading needs. Each product page features a brief description, a table detailing its functionality, an in situ product photograph, a 'performance web' visualising a product's strengths and weaknesses and, where relevant, an architect's comment on a product's added value.

Fixed shading devices

Product 1:
Overhang

Product 2:
Horizontal slats

Product 3:
Vertical fins

Product 4:
Fixed screens

Dynamic shading devices

Product 5:
External sliding shutters

Product 6:
External folding shutters

Product 7:
External hinged shutters

Product 8:
External venetian blinds

Product 9:
External roller blinds

Product 10:
External roller shutters

Product 11:
Drop arm awning

Product 12:
Folding arm awning

Product 13:
Dutch canopy awning

Product 14:
Internal roller blinds

Product 15:
Internal venetian blinds

Product 16:
Internal hinged shutters

Alternative shading devices

Product 17:
Closed cavity façade

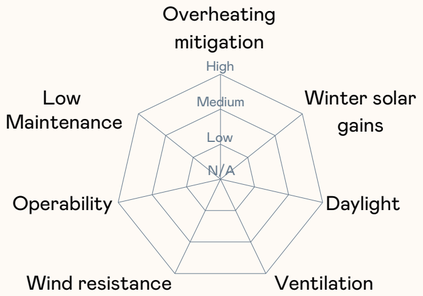
Product 18:
Window film

Product 19:
Planting

Summary of properties

How to read the performance web

Each product's performance web has seven metrics, each with its own 'radial spoke'. High performance metrics are closer to the outer edge of the web; low performance metrics are closer to the centre.



Fixed shading devices

Product 1:
Overhang

Product 2:
Horizontal slats

Product 3:
Vertical fins

Product 4:
Fixed screens

Dynamic shading devices

Product 5:
External sliding shutters

Product 6:
External folding shutters

Product 7:
External hinged shutters

Product 8:
External venetian blinds

Product 9:
External roller blinds

Product 10:
External roller shutters

Product 11:
Drop arm awning

Product 12:
Folding arm awning

Product 13:
Dutch canopy awning

Product 14:
Internal roller blinds

Product 15:
Internal venetian blinds

Product 16:
Internal hinged shutters

Alternative shading devices

Product 17:
Closed cavity façade

Product 18:
Window film

Product 19:
Planting

Product 1:
Overhang

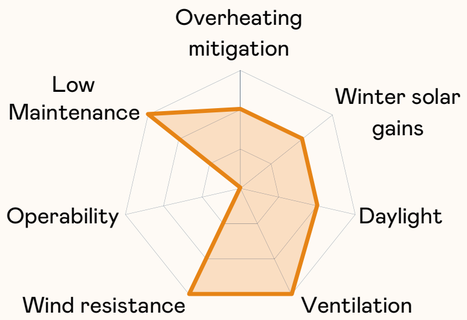
Technical spec

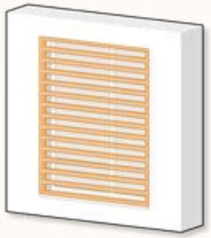
Overhangs, also known as brise soleil, are installed directly above windows, providing shade without obscuring views. They can be designed in a variety of ways, with timber or metal slats, solid or perforated metals. Overhangs can strongly influence a building's 'look' and must be carefully integrated into a façade's design. Rainwater runoff, wind microclimates and the impact of birds (they perch upon them), must also be factored into an overhang's design, installation and maintenance regime.

> "We sized the depth and density [of the overhang] to control solar gain."

Goldsmith Street, Norwich
Mikhail Riches

Overheating mitigation	Medium	Deviation from south orientation losses effectiveness. The overhang depth and sill height have an impact on the effectiveness
Winter solar gains	Medium	Allows low angle sun, but blocks some useful solar gains
Daylight	Medium	Reduced all year round
Ventilation	High	Full opening area effective
Wind resistance	High	Robust device without moving parts
Operability	N/A	Operation is not required. Suitable for reduced mobility occupants. The performance is always as per design
Maintenance	Low	Inspect fixings
Cost	£	





Product 2:
Horizontal slats

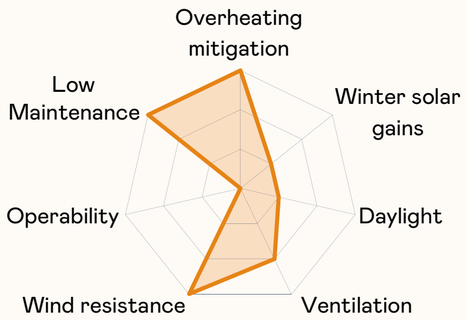
Technical spec

Horizontal slats, usually made with timber or metal, are often described as ‘sun breakers’. A typical product’s appearance is governed by the dimension of slats and the spaces between them – as well as their orientation when installed. Slats can be installed directly in front of a window, or at the edge of a balcony, although in both cases views out will be significantly reduced.

> “ The shading design had to be part of the overall identity of the build.”

Villa Caroisla, London
Nick Baker Architects

Overheating mitigation	High	Effective in all orientations. The space between slats depth and tilt angle have an impact on the effectiveness. The design needs to be adapted for each orientation, especially in East and West orientations when the sun angle is low
Winter solar gains	Low	Blocks some useful solar gains
Daylight	Low	Reduced all year round
Ventilation	Medium	Free area will be reduced depending on the slats design
Wind resistance	High	Robust device without moving parts
Operability	N/A	Operation is not required. Suitable for reduced mobility occupants. The performance is always as per design
Maintenance	Low	Inspect fixings
Cost	££££	



Product 3:
Vertical fins

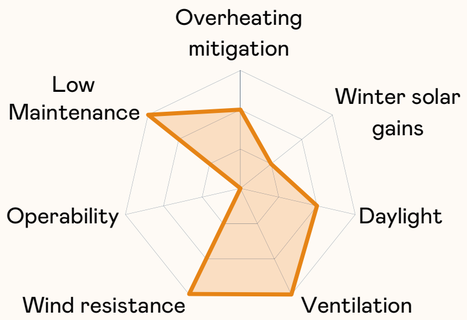
Technical spec

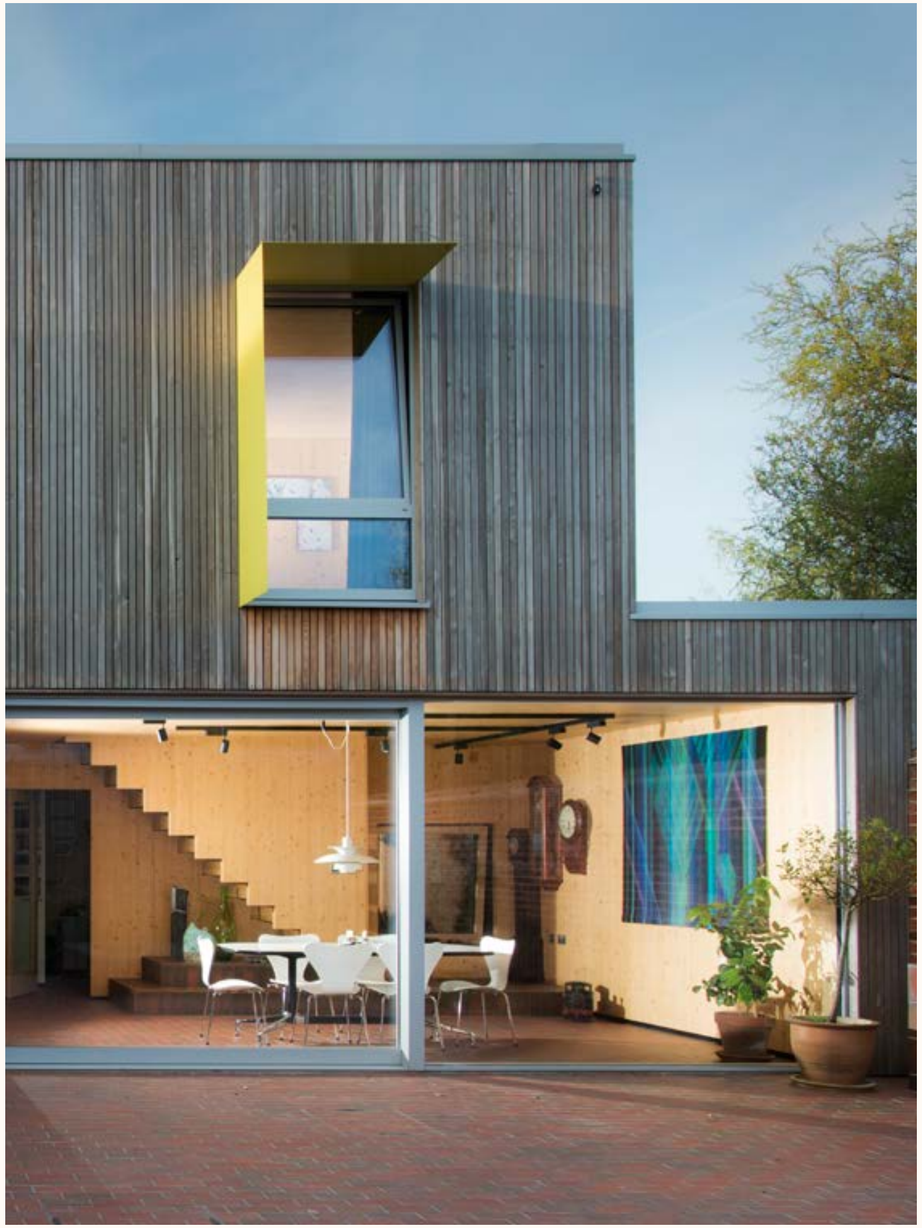
Vertical fins – usually made with timber or metal – are fitted alongside windows, providing shade without obstructing views. Depending on a façade's orientation, vertical fins can be combined with overhangs to increase a building's shade cover. As with brise soleil, wind microclimates and interference by birds, must be considered. Colour-coated fins can also be used to visually enhance façades.

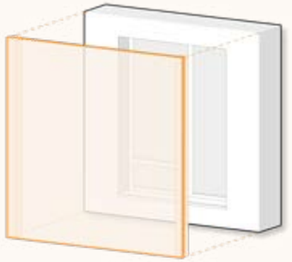
> " The yellow hue gives a pop of colour on the timber facade."

Hampshire Passivhaus
Ruth Butler Architects

Overheating mitigation	Medium	Effective in a very specific north east and north west orientation. The fin depth and glazing width have an impact on the effectiveness
Winter solar gains	Low	Blocks some useful solar gains
Daylight	High	Slightly reduced and in some instances improved depending on the colour of the fin which can reflect light inside
Ventilation	High	Full opening area effective
Wind resistance	High	Robust device without moving parts
Operability	N/A	Operation is not required. Suitable for reduced mobility occupants. The performance is always as per design
Maintenance	Low	Inspect fixings
Cost	£	







Product 4:
Fixed screens

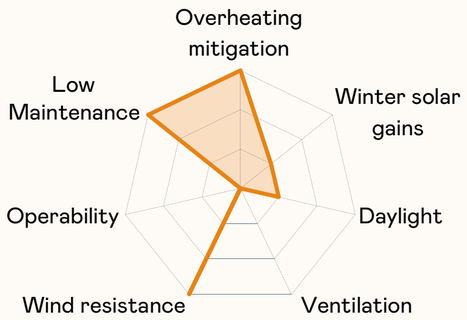
Technical spec

These metal perforated sheets, suitable for balconies and deck access buildings, can lend a unique aesthetic to a building while also contributing to residents' privacy. Where they are placed, however, is crucial - to avoid interference with ventilation and views, which can be significantly reduced.

> “ These patterned screens – with William Morris roses - shield west-facing access decks from bright sunlight.”

Colby Lodge, London
Pollard Thomas Edwards

Overheating mitigation	High	Effective in all orientations. Effectiveness depends on the screen's free area
Winter solar gains	Low	Blocks useful solar gains
Daylight	Low	Reduced all year round
Ventilation	N/A	Depends mainly on the position of the screen. The impact of the free area of the screen will increase the closer to the window it is installed
Wind resistance	High	Robust fixed element
Operability	N/A	Operation is not required. Suitable for reduced mobility occupants. The performance is always as per design
Maintenance	Low	Inspect fixings
Cost	£	



Product 5:
External sliding shutters

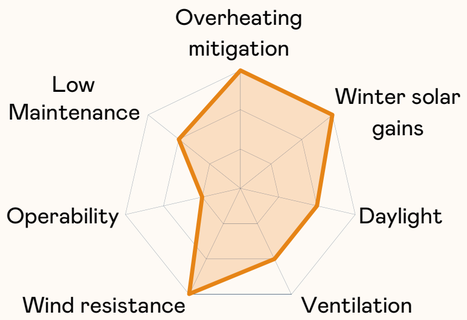
Technical spec

Sliding shutters made of waterproof, hardwearing materials attach to tracks fixed to building façades. Like sliding doors, shutters can slide away completely, revealing windows in full. Furthermore, their inherently dynamic nature can enliven a façade's appearance. When opened, shutters typically stack behind each other, while multiple shutters can be overlapped within the same track to fully shade wider windows.

Overheating mitigation	High	Blocks solar gains when fully closed. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully opened
Daylight	Medium	Depends on the free area of the shutters and how much they are closed. In winter allows maximum daylight when fully opened
Ventilation	Medium	Allows ventilation, but depends on the free area of the shutters and how much they are closed
Wind resistance	High	Robust device fitted within channels
Operability	Low	Manually operated that requires leaning out the window. Not suitable for reduced mobility occupants. The performance depends on occupant behaviour
Maintenance	Medium	Inspect channels and wheels
Cost	££££	

> "The sliding mechanism of the shutters and their position when open breaks down the façade to avoid large expanses of blank wall."

Hanham Hall, South Gloucestershire
HTA



Product 6:
External folding shutters

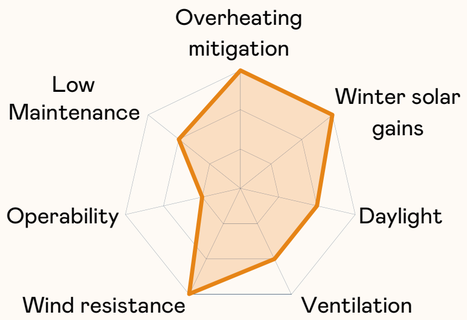
Technical spec

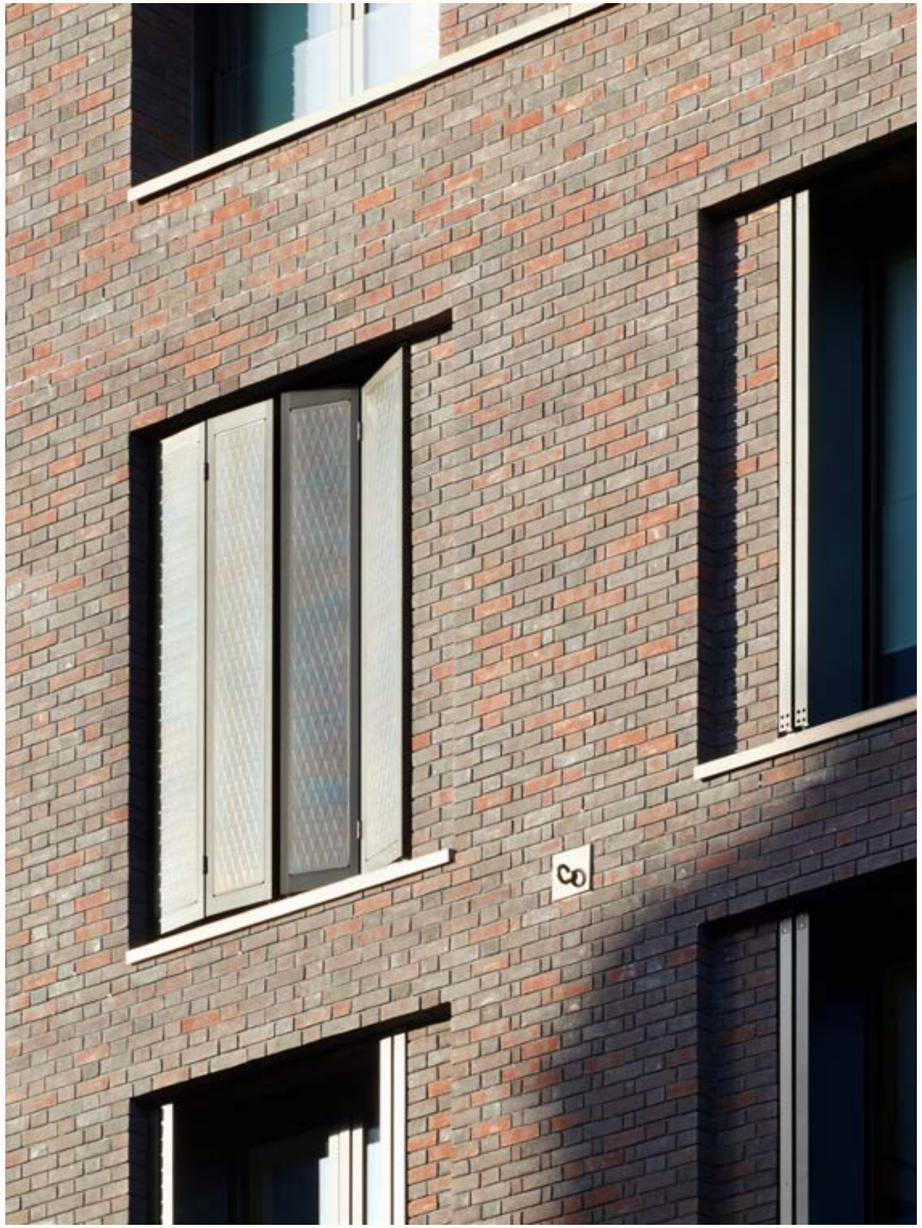
Typically, external folding shutters are made of horizontal timber or metal slats, but perforated metal screens can also be used. Depending on the depth of the window reveal, shutters fold within the reveal or project off of the façade. Multiple shutters can be hinged together to shade wide windows.

Overheating mitigation	High	Blocks solar gains when fully closed. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully opened
Daylight	Medium	Depends on the free area of the shutters and how much they are closed. In winter allows maximum daylight when fully opened
Ventilation	Medium	Allows ventilation, but depends on the free area of the shutters and how much they are closed
Wind resistance	High	Robust device fitted within channels
Operability	Low	Manually operated that requires leaning out the window. Not suitable for reduced mobility occupants. The performance depends on occupant behaviour
Maintenance	Medium	Inspect channels, wheels and hinges
Cost	££££	

> “ Finished in patinated bronze sheet-metal with a subtle triangular embossed pattern that aligns with the brickwork coursing.”

Oxbourne House, London
Fletcher Priest Architects





Product 7:
External hinged shutters

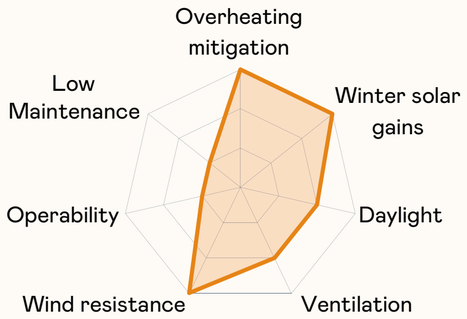
Technical spec

External hinged shutters, usually made of timber (and colour-coated), can transform the appearance of façades. There are two types: those made of slats which allow certain degree of daylight and views out and solid shutters - which have a 'block-out' and privacy function. Occupants lean out of windows to close the shutters, posing a safety risk when installed at higher levels.

Overheating mitigation	High	Blocks solar gains when fully closed. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully opened
Daylight	Medium	Depends on the free area of the shutter. In winter allows maximum daylight when fully opened
Ventilation	Medium	Allows ventilation, but depends on the free area of the shutters
Wind resistance	High	Robust device with suitable locking system
Operability	Low	Manually operated that requires leaning out the window. Not suitable for reduced mobility occupants. The performance depends on occupant behaviour
Maintenance	High	Inspect hinges and locking system. Re-painting every few years is required
Cost	££	

> "These shutters blend well with the historic built environment - their design and colour animates the street, and they reduce heat gain during the hot summer days."

Sliema Palazzino, Malta
Architecture XV



Product 8:

External venetian blinds

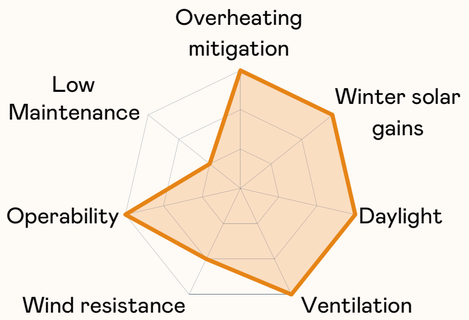
Technical spec

External venetian blinds consist of thin, deep, metal (often coloured) slats that can be manually controlled to allow views out, whilst still providing solar control. Slat tilt angles control privacy levels too. When retracted, slats stack in a box installed in the window head, leaving the window fully exposed.

Overheating mitigation	High	Blocks most of the solar gains when fully extended. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	High	The thin slats maximise the free area to allow daylight ingress. In winter allows maximum daylight when fully retracted
Ventilation	High	Allows ventilation, but depends on the free area between the slats, the tilt angle and how much the blind is extended
Wind resistance	Medium	Side channels are more robust than cable guides. The blind automatically retracts in high winds if linked to sensors
Operability	High	Motorised and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	High	Inspect channels and lift tape. Access to the motor in the blind box is required
Cost	£££	

> “ An elegant way to reduce solar gains in the summer and maximise solar gains in the winter.”

Camden Passive House, London
Bere Architects

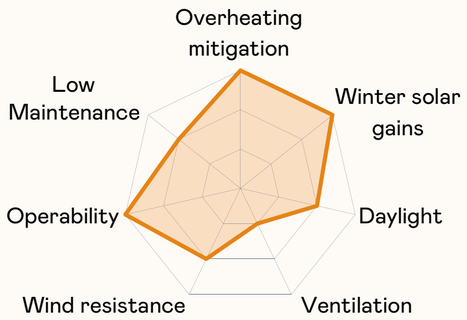


Product 9:
External roller blinds

Technical spec

This product is a box installed in the window head containing a blind - a weather-resistant fabric - with side channels or cables allowing users to guide the blind upwards into the box or downwards to cover the glazing. The blind can be coloured and/or have different levels of opacity, providing a degree of glare control (and views out). Suitable for shading façades and roofs with complex geometries.

Overheating mitigation	High	Blocks solar gains when fully extended. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	Medium	The mesh material is designed to facilitate adequate light levels in winter allowing maximum daylight when fully retracted
Ventilation	Low	The mesh material allows for a certain degree of ventilation, but it will mainly depend on how much the blind is extended
Wind resistance	Medium	Side channels are more robust than cable guides. The blind automatically retracts in high winds if linked to sensors
Operability	High	Motorised and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	Medium	Inspect fabric and channels or cables. Access to the motor in the blind box is required
Cost	£££	



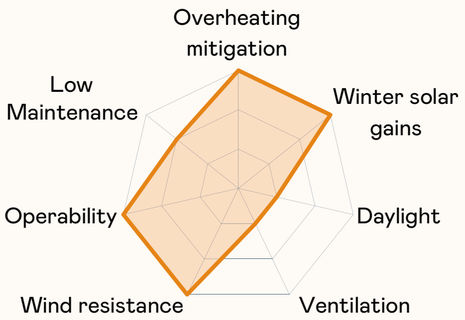
Product 10:
External roller shutter

An external roller shutter is made of connected rigid slats, usually PVC or aluminium, that retract into a box installed in the window head. Small gaps between the slats provide a limited amount of daylight and ventilation and when fully extended provide a ‘block-out’ function.

Overheating mitigation	High	Blocks solar gains when fully extended. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	Low	The gaps between the slats allow for a certain degree of daylight, but it will mainly depend on how much the shutter is retracted. In winter allows maximum daylight when fully retracted
Ventilation	Low	The gaps between the slats allow for a certain degree of ventilation, but it will mainly depend on how much the shutter is retracted
Wind resistance	High	Rigid slats guided by side channels can withstand strong winds
Operability	High	Motorised and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	Medium	Inspect channels and slats. Access to the motor in the shutter box is required
Cost	££	

Technical spec

Central Somers Town, London
Adam Khan Architects

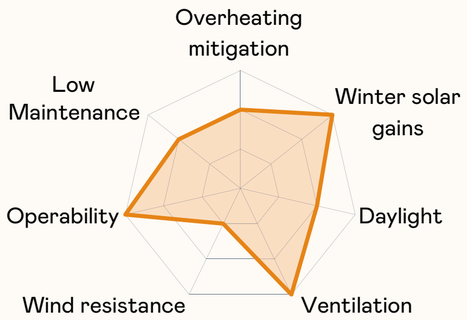


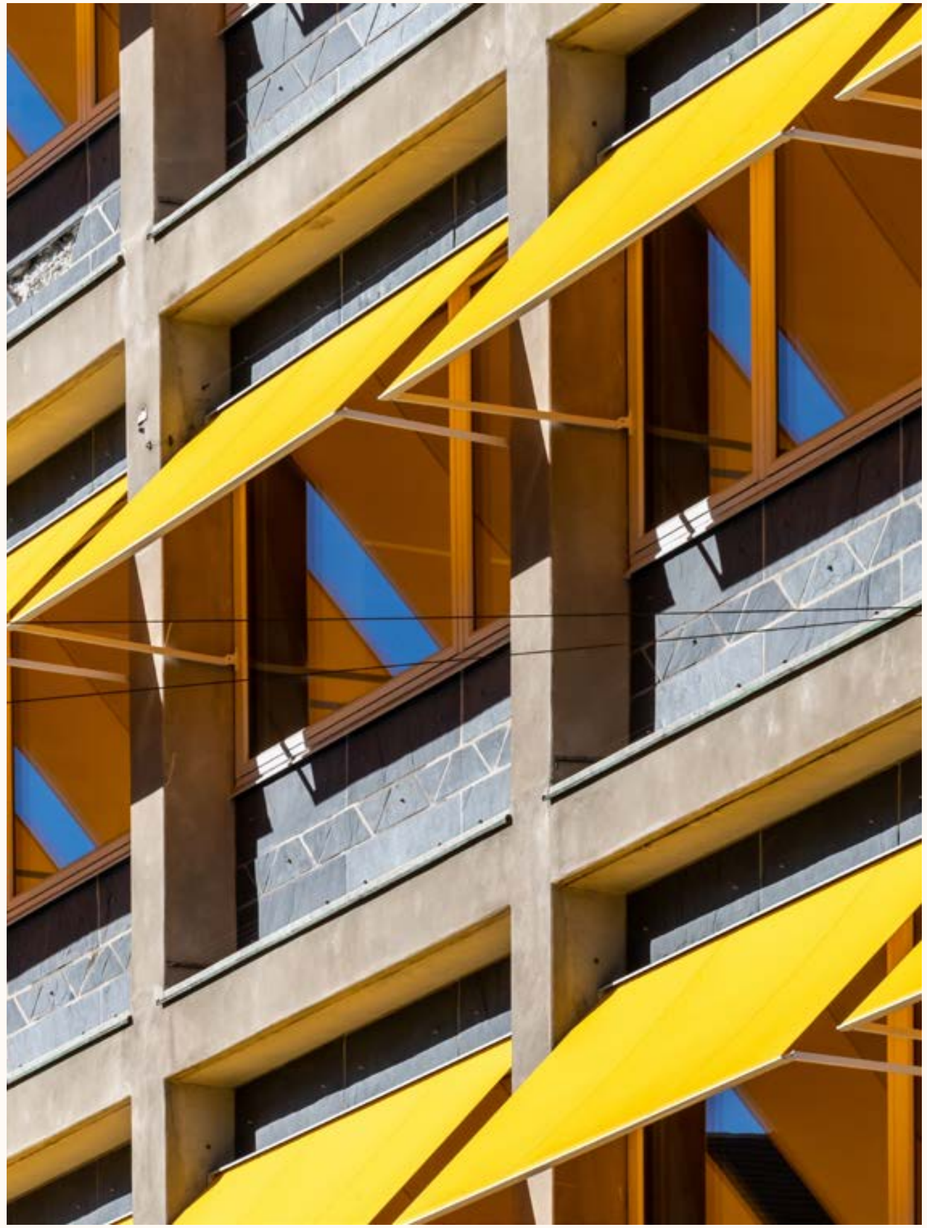
Product 11:
Drop arm awning

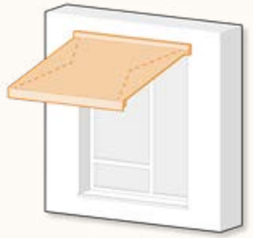
Technical spec

A drop arm awning is a three dimensional shading product more typically used on commercial shopfronts. It consists of a box installed in the window head, containing a blind made of weather resistant fabric, with spring-loaded, hinged side arms that lower and keep the fabric taut.

Overheating mitigation	Medium	Deviation from south orientation loses efficacy. Effectiveness depends on the awning depth and window sill height
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	Medium	Daylight reduction depends on the colour of the fabric and the arm length
Ventilation	High	Large effective ventilation area
Wind resistance	Low	The side arms are not able to withstand continuous high wind levels and therefore the awning should be equipped with sensors to automatically retract
Operability	High	Manual and automatic options are available. Automatic option suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	Medium	Inspect side arms and fabric. Access to the blind box is required
Cost	££	





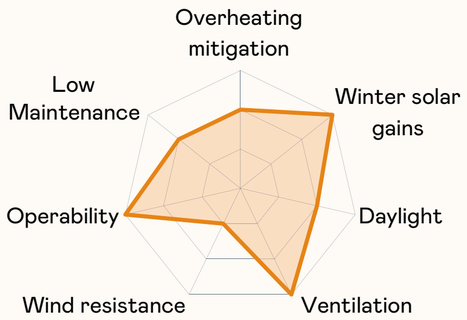


Product 12:
Folding arm awning

Technical spec

A folding arm awning consists of a box installed in the window head, containing a blind made of weather resistant fabric, with spring-loaded, folding arms that retract and keep the fabric taut. Projecting off the façade, awnings provide sun control particularly to large, glazed areas, as well as shading people sitting below. The fabric is extended at a slight angle, allowing views out.

Overheating mitigation	Medium	Deviation from south orientation loses efficacy. Effectiveness depends on the awning depth and window sill height
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	Medium	Daylight reduction depends on the colour of the fabric and the arm length
Ventilation	High	Large effective ventilation area
Wind resistance	Low	The side arms are not able to withstand continuous high wind levels and therefore the awning should be equipped with sensors to automatically retract
Operability	High	Manual and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the occupant behaviour
Maintenance	Medium	Inspect arms. Access to the motor in the cassette is required
Cost	££££	

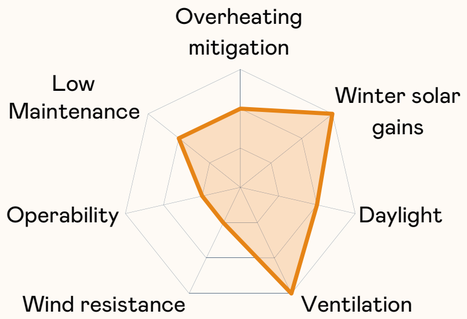


Product 13:
Dutch canopy awning

Technical spec

This weather-resistant blind, fixed to a frame - consisting of multiple spring-loaded hinged arms that lower and keep the fabric taut – creates a rounded quarter circle that projects off of the façade. All sides of the frame are covered by the blind affording additional solar protection. Typically considered well suited for historic buildings.

Overheating mitigation	Medium	Deviation from south orientation loses efficacy. Effectiveness depends on the awning depth and window sill height
Winter solar gains	High	Allows maximum solar gains when fully retracted
Daylight	Medium	Daylight reduction depends on the colour of the fabric and the arm length
Ventilation	High	Large effective ventilation area
Wind resistance	Low	Should be retracted in strong winds
Operability	Low	Manually operated. The performance depends on the occupant behaviour
Maintenance	Medium	Inspect framework and operating mechanism
Cost	££	



Product 14:
Internal roller blinds

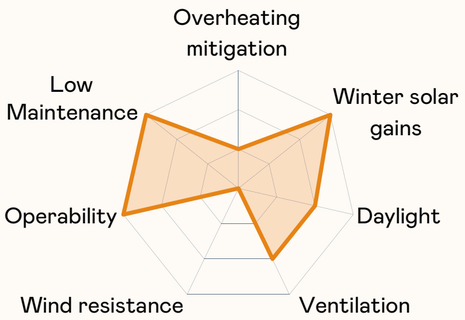
Internal roller blinds – which come in multiple textures, colour and patterns - are fixed to the ceiling or wall above windows. Fabric can be opaque and provide blackout function, or have varying degrees of transparency, to calibrate privacy and glare control levels, while also allowing views out. Easily combined with external shading products.

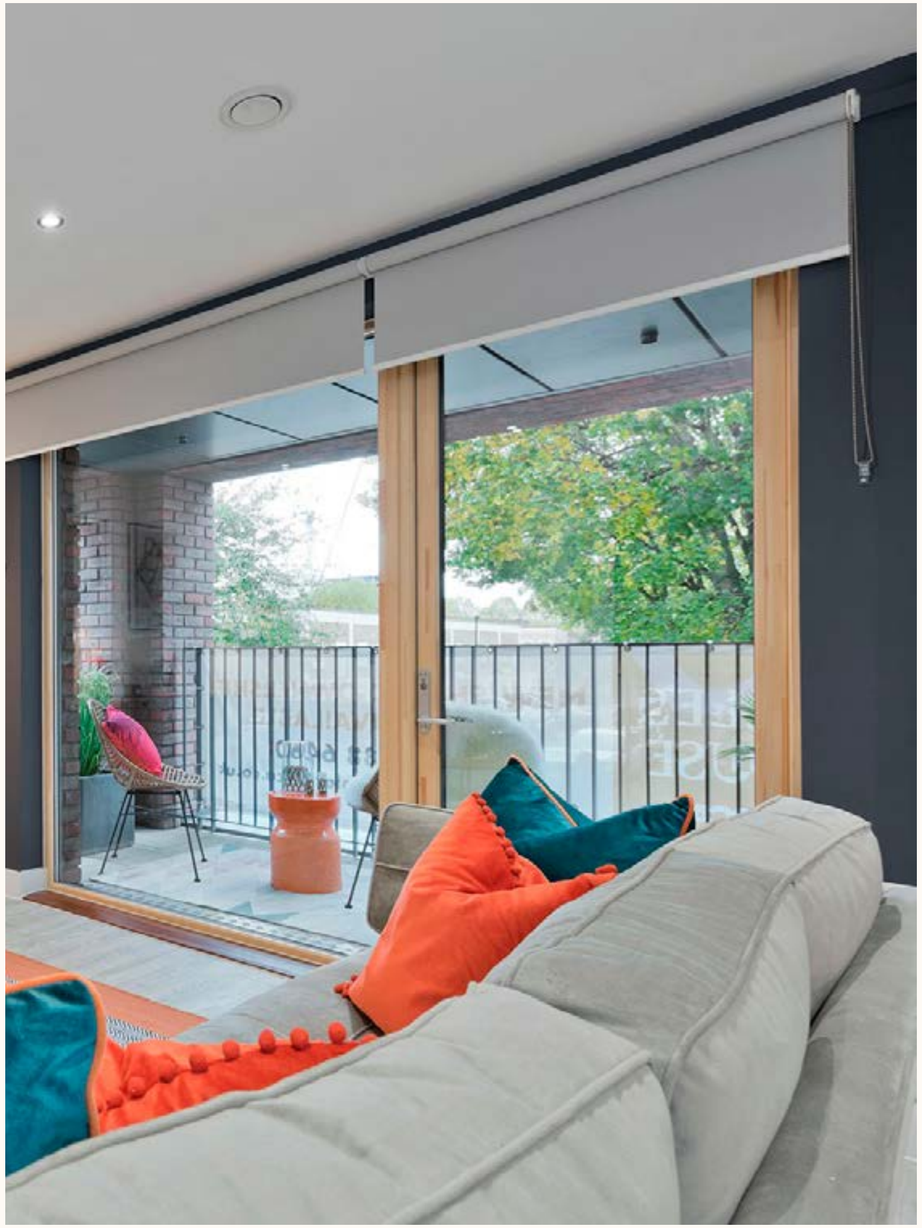
Note: Internal roller blinds should not be taken into account for Building Regulations overheating compliance.

Overheating mitigation	Low	Does not significantly reduce the solar gains
Winter solar gains	High	Allows maximum solar gain when fully retracted
Daylight	Medium	Daylight level depends on the fabric type and colour. It can assist with glare control when lowered on sunny days
Ventilation	Medium	The mesh material allows for a certain degree of ventilation but it will mainly depend on how much the blind is closed
Wind resistance	N/A	Not designed for wind resistance. Unless guided by cables or channels, blind can move when window is open during strong winds
Operability	High	Manual and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	Low	Access to the blind box is required
Cost	£	

Technical spec

Jolles House, London
Pollard Thomas Edwards





Product 15:
Internal venetian blinds

Technical spec

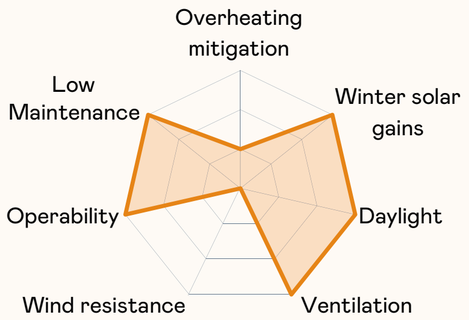
Internal venetian blinds consist of thin, deep, metal (often coloured) slats that can be manually controlled to allow views out, whilst still providing solar control. Slat tilt angles control privacy levels too. When retracted, slats stack in a box installed in the window head, leaving the window fully exposed.

Note: Internal venetian blinds should not be taken into account for Building Regulations overheating compliance.

Overheating mitigation	Low	Does not significantly reduce the solar gains
Winter solar gains	High	Allows solar gain when fully retracted
Daylight	High	The thin slats maximise free area which allow daylight entry. Maximum daylight entry allowed in winter
Ventilation	High	Ventilation rate depends on the free area between slats and how much of the window is covered by product
Wind resistance	N/A	Not designed for wind resistance. Unless guided by cables or channels, blind can move when window is open during strong winds
Operability	High	Manual and automatic options are available. Suitable for reduced mobility occupants. The performance depends on the control option and occupant behaviour
Maintenance	Low	Check cords for wear
Cost	£	

> “ The blinds were just one of many elements that residents were able to customise themselves.”

Beechwood Village, Basildon
Pollard Thomas Edwards

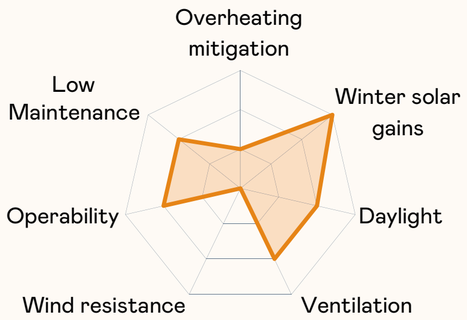


Product 16:
Internal hinged shutters

Technical spec

This product consists of multiple panels – painted timber louvres - fitted within a frame and fixed to the internal window reveal. Shutters can be tracked for larger windows. Louvres can be fixed or operable, to allow for control of privacy and views. Café style shutters allow for the lower portion of glazing to be shaded for privacy while light enters through the unshaded upper portion.

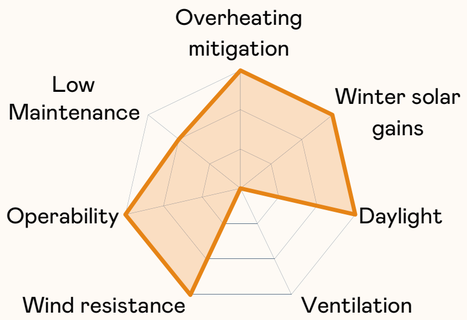
Overheating mitigation	Low	Does not significantly reduce the solar gains
Winter solar gains	High	Allows maximum solar gain when fully opened
Daylight	Medium	Flexible, depending on free area between slats and percentage of shutters closed
Ventilation	Medium	Allows ventilation, but depends on the free area between slats and how much the shutters are closed
Wind resistance	N/A	Not designed for wind resistance
Operability	Medium	Manually operated. Suitability for reduced mobility occupants depends on the sill height. Performance depends on the occupant behaviour
Maintenance	Medium	Inspect hinges and locking system
Cost	£££	



Product 17:
Closed cavity façade

The performance of a shading product installed within a glazed vented cavity is similar to the same product if it were installed externally. The shading products commonly used in this type of façade are venetian blinds or roller blinds. The use of closed cavity façades with integrated shading products is sometimes used in tall, glazed buildings.

Overheating mitigation	High	The performance of the shading device is similar to the same device installed externally only if installed within a vented false façade. Effective in all orientations
Winter solar gains	High	Allows maximum solar gains when slats turned horizontally or when blind is fully retracted
Daylight	High	Allows optimum daylight when slats turned horizontally or when blind is fully retracted
Ventilation	N/A	Curtain wall system does not allow natural ventilation
Wind resistance	High	This system will not be affected by wind due to protection from the curtain wall system
Operability	High	Automatically operated. Suitable for reduced mobility occupants.
Maintenance	Medium	Being protected from the environment reduces wear and tear. Access to the cavity is required
Cost	££££	

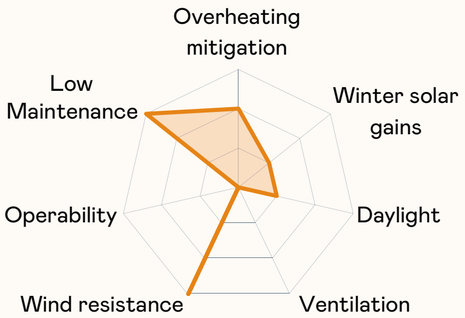


The Shard, London
Renzo Piano

Product 18:
Window film

Window film is a self-adhesive film with solar control properties that is applied to the surface of the glass. Depending on the product, it can significantly change glazing and daylight colour. Some films also have privacy function whilst allowing views out. Typically used on existing buildings where retaining the look of existing façades is required.

Overheating mitigation	Medium	Blocks solar gains. Effective in all orientations
Winter solar gains	Low	Blocks useful solar gains
Daylight	Low	Blocks some degree of daylight all year round. It changes the colour of the light
Ventilation	N/A	Window film does not affect ventilation
Wind resistance	High	Permanently adhered to the glass
Operability	N/A	Operation is not required. Suitable for reduced mobility occupants. Performance always as per design
Maintenance	Low	Cleaning required
Cost	£	



Product 19:
Planting

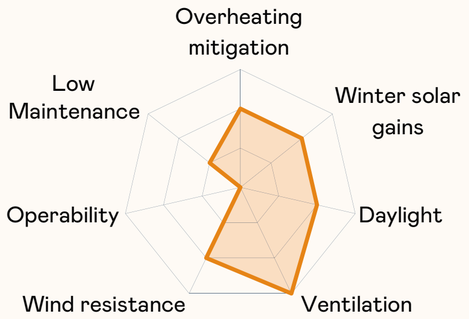
Deciduous plants are a natural way to increase biodiversity and lend social value while providing shade and allow for winter solar gain. However, it is difficult to accurately measure and model performance, given the changing nature of plant-life, both seasonally and across their lifespans. Often used in tandem with other shading products.

Note: Planting should not be taken into account for Building Regulations overheating compliance.

Overheating mitigation	Medium	Depends on the size and amount of leaves of plant species. Effective in all orientations
Winter solar gains	Medium	Loss of leaves will allow solar gains during the winter months. Branches will still block some useful solar gains
Daylight	Medium	Depends on the size and amount of leaves of plant species
Ventilation	High	Leaves and branches are flexible allowing air movement without great resistance
Wind resistance	Medium	Leaves and branches may not resist strong winds
Operability	N/A	Operation is not required. Real performance is unpredictable
Maintenance	High	Requires regular watering and trimming
Cost	£££	

> “ It gives back to the street in so many ways – with colour, biodiversity and even social value – kids love playing alongside it when they walk past.”

Diespeker Wharf, London
Pollard Thomas Edwards



Appendices

Performance

The primary goal of a shading product is to reduce unwanted solar energy – heat – from entering a building or room. However, there are other features that may be less desirable but must be considered by designers. The data presented in the following appendices is intended to help designers select an appropriate product. As well as looking at how to optimise the primary performance objective – stopping direct sun – it will also look at other impacts on daylight and ventilation.

The modelling results presented here have been based on a 'typical' bedroom and have deliberately been kept as general as possible, presenting only variables that depend directly on the shading device. It can help guide designers towards an appropriate solution but is no substitute for detailed design consideration and project-specific modelling.

Solar Performance
Cumulative solar gain and peak solar gain are used to demonstrate solar performance. Both are taken over the period May to September, when the overheating risk is at its highest.

- Cumulative solar gain can be thought of as the total solar energy entering a room over the period. It can translate to cooling energy saved, as well as giving a picture of a product's overall shading performance
- Peak solar gain is the highest solar heat gain in a room at any one point across the period. The method of heat removal, whether natural or mechanical, must be able to cope with this peak.

For fixed products, the data shown can be used to optimise the shade's dimensions and to demonstrate how shading performance changes with orientation.

Tables showing how a shade's efficacy varies throughout the year and at any time of day are presented where appropriate, highlighting beneficial winter solar gains.

For dynamic products, the focus is on peak conditions as they should only be used when needed. Solar gain across the peak summer day is used to compare different materials for blinds and infills for shutters, and whether they are located internally or externally to the glazing.

Ventilation
Shading products can also impact upon natural ventilation although only products located directly in front of windows will have a significant effect.

Depending on the context, the reduction of natural ventilation by a shading product can be negative, neutral, or in some cases positive. Where there are large amounts of internal heat gain, and natural ventilation is the only means to remove it, then a reduction is likely to be negative. However, where there is air conditioning, or small internal heat gains, the reduction could be neutral, far outweighed by the benefits, or even positive if it is hotter outside.

Here, the focus is on shutters and venetian blinds, with various options for shutter infill compared – from an open slat design to a relatively closed weather louvre.

Daylight
Shading products can have a negative impact on internal daylight levels, and lead to greater use of artificial lighting. On a bright or sunny day, fixed products are unlikely to reduce internal daylight below acceptable levels, but on dull or overcast days, use of artificial light may be necessary.

Dynamic products need not be used during overcast conditions minimising their impact on daylight. When they are used to prevent direct sunlight however, the impact on internal light levels can trigger usage of artificial light.

Consequently, two different daylight plots are used:

- for fixed products - a daylight factor plot, calculated using an overcast sky
- for dynamic products - an illuminance plot, calculated using a sunny sky.

Product index

Product 1:
Overhang

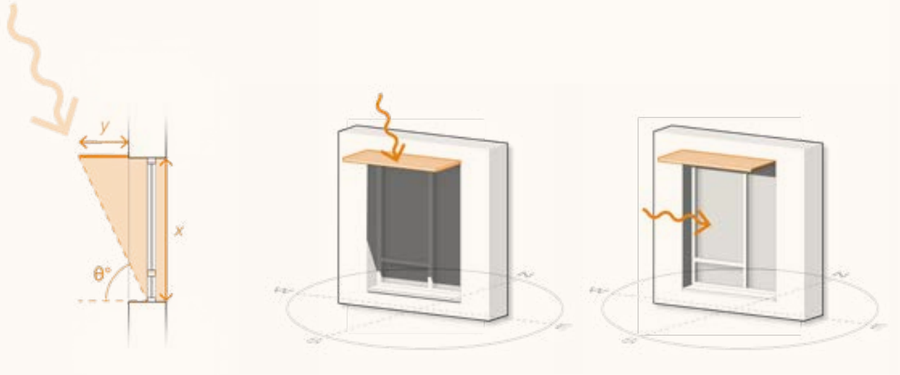
Product 11:
Drop arm awning

Product 12:
Folding arm awning

Product 13:
Dutch canopy awning

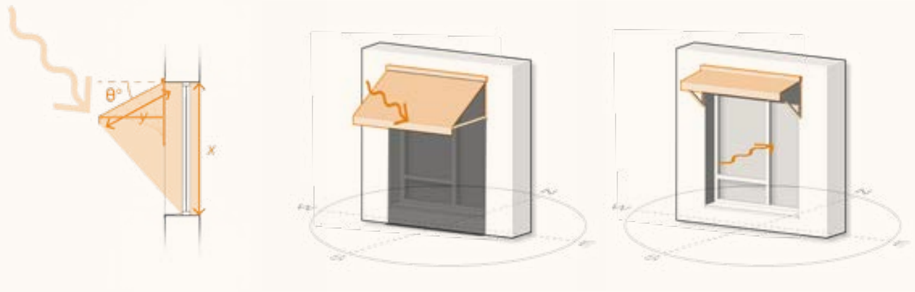
All products consisting of a shading element above the window, whether fixed or dynamic, have been grouped together, as their performance is measured in a similar way with slight variations, the main factor being the dimension of the product, which can vary greatly.

Product 1:
Overhang

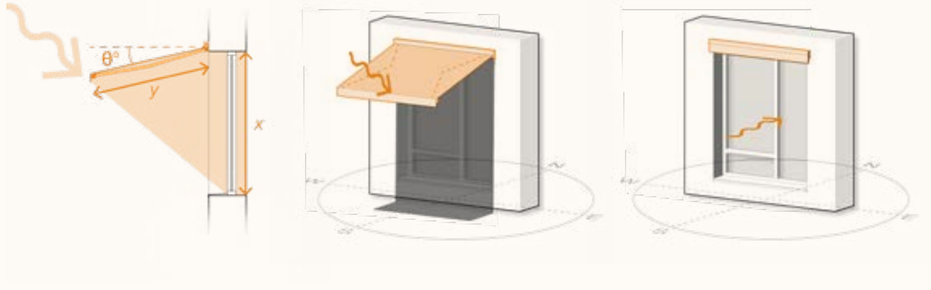


Section Summer Winter

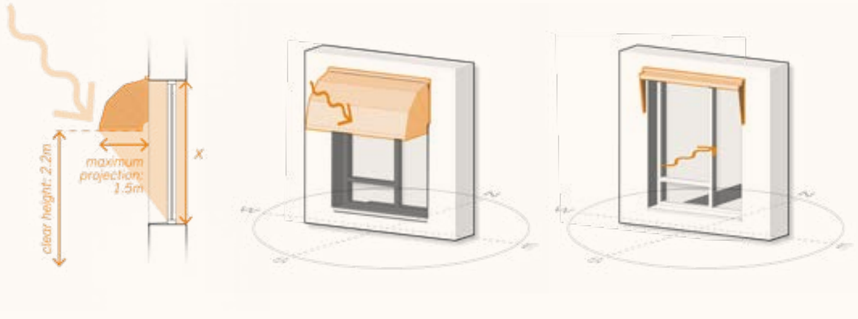
Product 11:
Drop arm awning



Product 12:
Folding arm awning



Product 13:
Dutch canopy awning

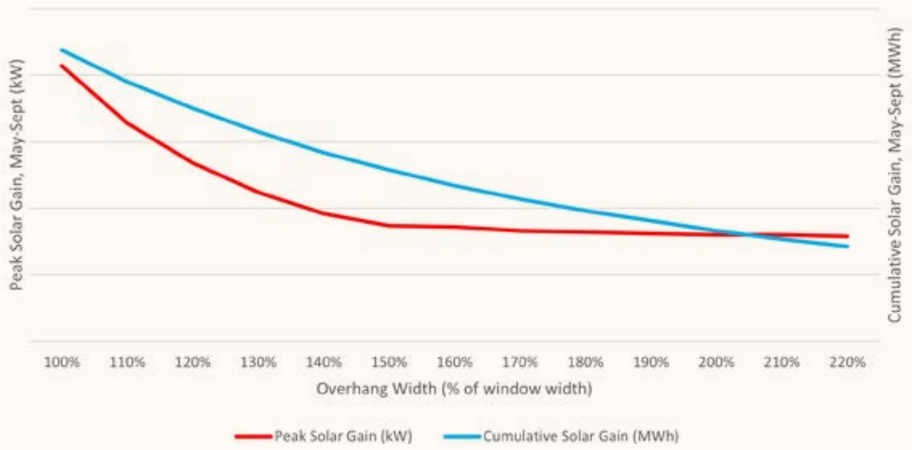


Product index
1, 11, 12, 13

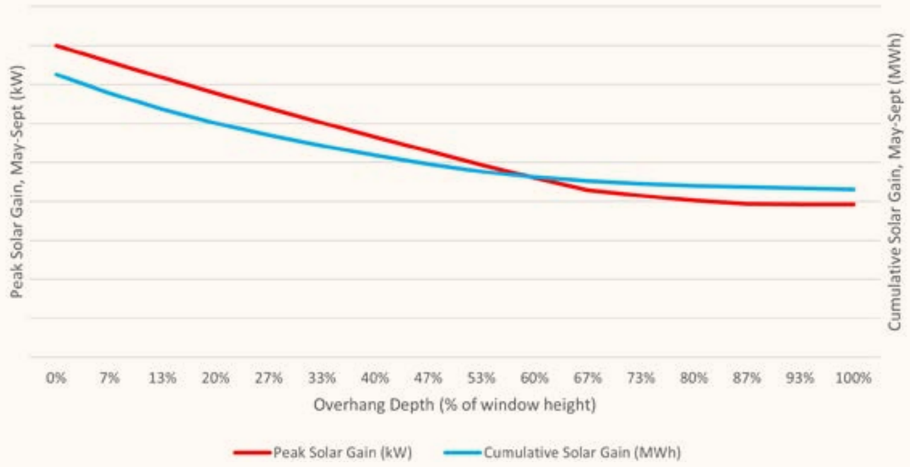
Dimensions: As can be seen from the data, there are points beyond which increasing the dimensions offers diminishing returns. However, as this varies for peak and cumulative gains, the chosen dimensions should reflect whichever of these quantities are prioritised.

Orientation effects: As can be seen, these products reduce solar gain most significantly in a southern orientation although this effect is much more dramatic for peak compared to cumulative gains.

Dimensional optimisation



Effect of overhang width on peak and cumulative solar gain



Effect of overhang depth on peak and cumulative solar gain

Orientation effects

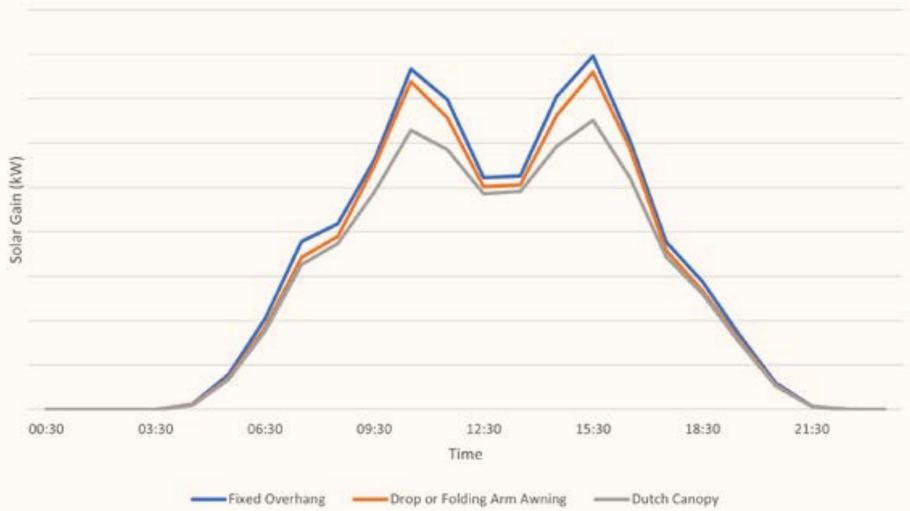
Effect of overhang shading with orientation - peak

Effect of overhang shading with orientation - cumulative

Product index
1, 11, 12, 13

Awning and fixed overhang comparison: As this graph demonstrates, there are only small differences in the performance of a fixed overhang and operable awnings at the same dimensions when deployed on a hot summer day. Small improvements can be seen in the drop- or folding-arm awnings resulting from their drop below the window head, and the Dutch canopy awning shows markedly better performance when the sun moves away from due south, due to its side panels.

Comparison of products



Comparison of awnings and overhang - peak summer day solar gain

Product index
1, 11, 12, 13

Annual efficacy: This shows how products perform best during peak summer, and still permit a good deal of beneficial winter solar gain.

Daylight: As can be seen, these products reduce daylight levels significantly thanks to a reduced sky-view. Of course for the operable awnings this is less of an issue as they can be retracted.

Annual efficacy

South Facing window, 1x1.5m window, 1.1m sill, no shading

Month	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Jan						100	100	100	100	100	100	100	100				
Feb					100	100	100	100	100	100	100	100	100	100			
Mar				100	100	100	100	100	100	100	100	100	100	100			
Apr			0	100	100	100	100	100	100	100	100	100	100	100	0		
May		0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	
Jun	0	0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0
Jul		0	0	0	100	100	100	100	100	100	100	100	100	0	0	0	0
Aug		0	0	100	100	100	100	100	100	100	100	100	100	100	0	0	
Sep			0	100	100	100	100	100	100	100	100	100	100	100	0		
Oct				100	100	100	100	100	100	100	100	100	100				
Nov					100	100	100	100	100	100	100	100	100				
Dec						100	100	100	100	100	100	100					

Annual efficacy of unshaded case

South Facing Room, 1x1.5m window, 1.1m sill, 1m OH @window width

Month	04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Jan						95	89	84	80	82	87	93	99				
Feb					97	90	82	75	70	72	78	86	93	99			
Mar				97	91	83	72	62	54	59	68	79	88	95			
Apr			0	90	83	74	57	41	27	40	56	73	83	90	0		
May		0	0	0	78	66	46	22	1	23	47	67	78	0	0	0	
Jun	0	0	0	0	75	64	44	21	1	20	42	63	75	0	0	0	0
Jul		0	0	0	77	66	47	24	3	19	41	63	75	0	0	0	0
Aug		0	0	88	81	72	54	33	16	29	49	69	80	87	0	0	
Sep			0	93	86	77	63	52	43	53	65	79	87	94	0		
Oct				98	92	83	75	68	64	71	78	87	95				
Nov					97	91	84	79	77	81	87	94	100				
Dec						95	89	85	82	85	90	96					

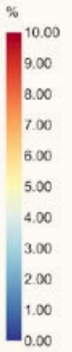
*Numbers show percentage of window subject to direct radiation at given month and time

Annual efficacy of shaded case

Daylight factor images – overcast

Unshaded daylight factor plot

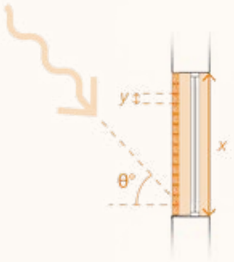
Daylight factor plot with overhang



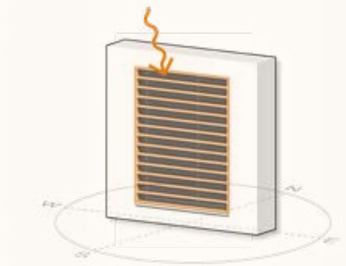
Contour scale/legend for daylight factor plots

Product 2:
Horizontal slats

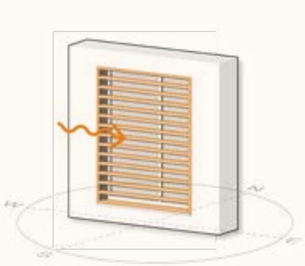
Product 2:
Horizontal slats



Section



Summer



Winter

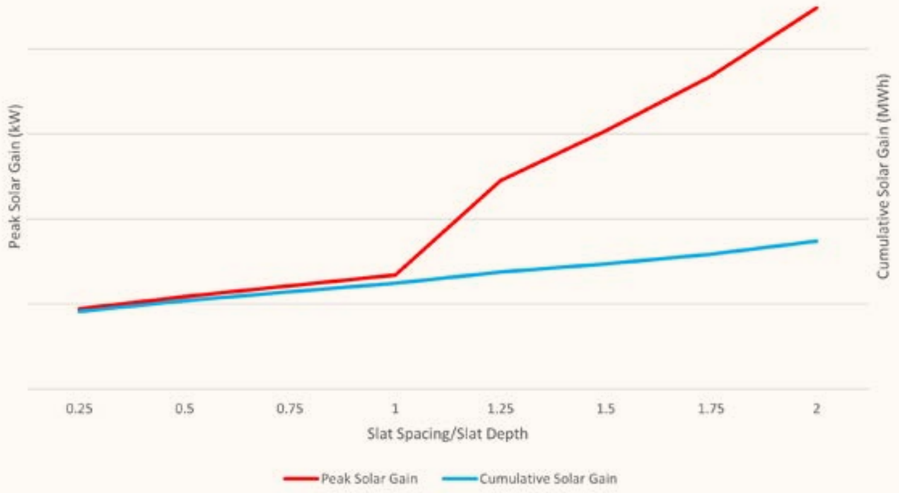
Product index
2

Dimensional optimisation (for a south facing room): There is a clear slat depth to spacing ratio at which peak solar gains are reduced significantly. This will vary with orientation and latitude.

Annual efficacy (for slat spacing/ slat depth = 1, south facing): This shows complete exclusion of direct sunlight through the summer months, while permitting some beneficial winter solar gain.

Daylight: As might be expected by their excellent shading performance, these products have a significant detrimental effect on daylight in the room (image for slat spacing/depth = 1)

Dimensional optimisation



Peak and cumulative solar gain for different ratios of slat depth to slat spacing

Annual efficacy

Horizontal slats, S/D = 1, south facing Room

Month	Time 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Jan						58	59	60	62	61	59	58	58				
Feb					34	40	43	46	48	47	44	42	38	26			
Mar				0	9	15	18	20	22	21	19	17	12	0			
Apr			0	0	0	0	0	0	0	0	0	0	0	0	0		
May		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Jun	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Jul		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Aug		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Sep			0	0	1	4	6	8	8	7	6	3	0	0	0		
Oct				12.9	30	34	36	38	39	37	35	33	25				
Nov					52	54	55	57	58	56	54	53	51				
Dec						63	63	65	66	65	63	63					

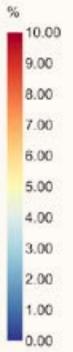
*figures show approximate percentage of window subject to direct sun at given month and time of day

Annual efficacy of shaded case

Daylight factor images – overcast

Unshaded daylight factor plot

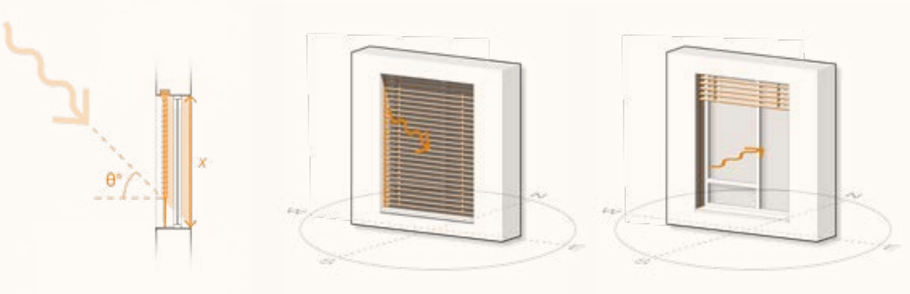
Daylight factor plot with horizontal slats



Contour scale/legend for daylight factor plots

Product 8:
External venetian blinds

Product 8:
External venetian blinds



Section

Summer

Winter

Product index
8

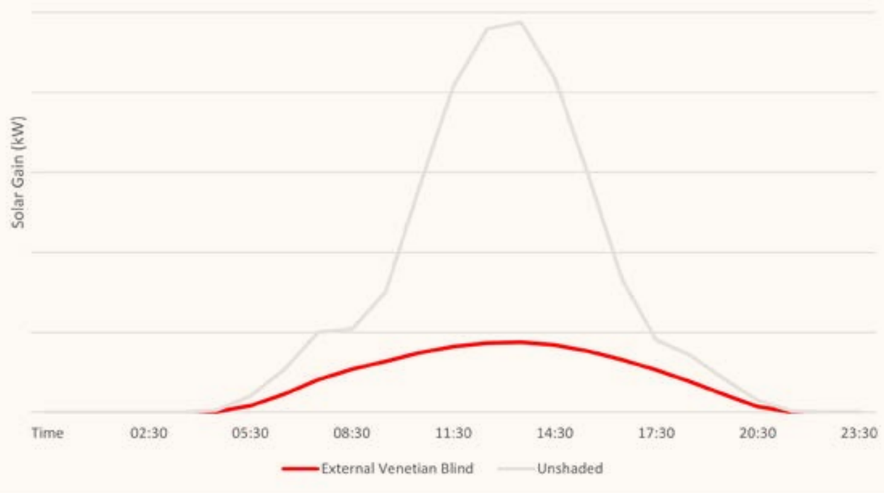
Performance here assumes slats are adjusted to block direct sun.

Solar gain: Limited to solely diffuse and reflected radiation, thus showing a significant improvement over the unshaded case.

Ventilation: Only a small reduction in the window's ventilation performance due to relatively aerodynamic blades.

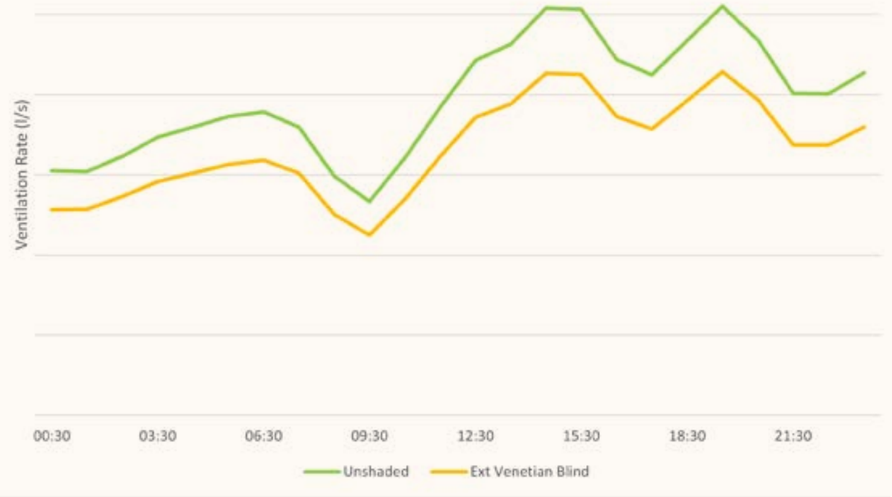
Daylight: Shows that good daylight levels can be achieved on a sunny day with blades adjusted to exclude direct sun.

Peak Day Performance - solar gain



External venetian blind - peak summer day solar gain

Peak Day Performance - ventilation



External venetian blind - typical summer day natural ventilation rate

Daylight factor images – sunny sky

External Venetian Blind, daylight lux plot, sunny sky

Contour scale/legend for lux plots sunny sky

Product index

Product 4:
Fixed screens

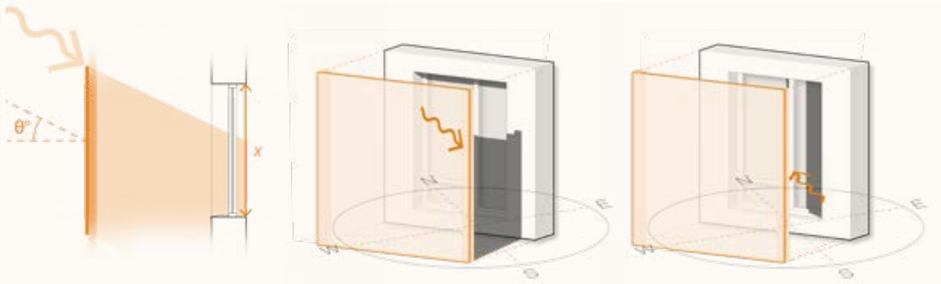
Product 5:
External sliding shutters

Product 6:
External folding shutters

Product 7:
External hinged shutters

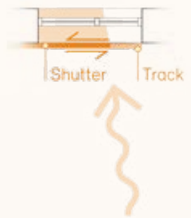
All products consisting of a continuous infill plane of shade extended in front of the window, whether fixed or dynamic, have been grouped together as their performance is measured in a similar way. The main factor is the infill of the panel which can vary greatly.

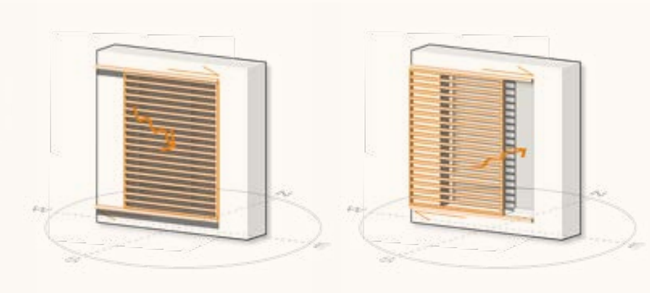
Product 4:
Fixed screens



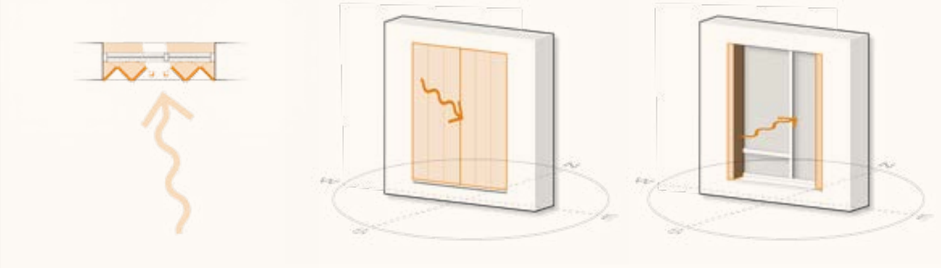
Section Summer Winter

Product 5:
External sliding shutters

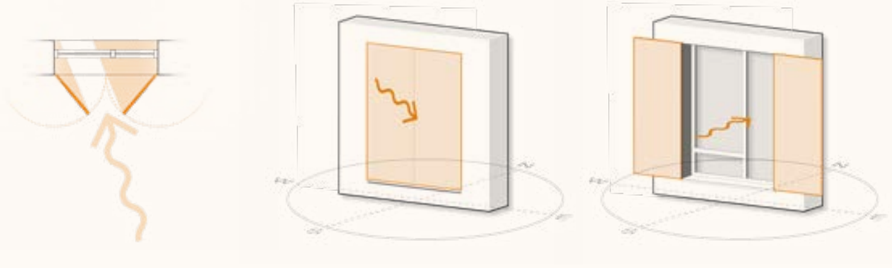




Product 6:
External folding shutters



Product 7:
External hinged shutters

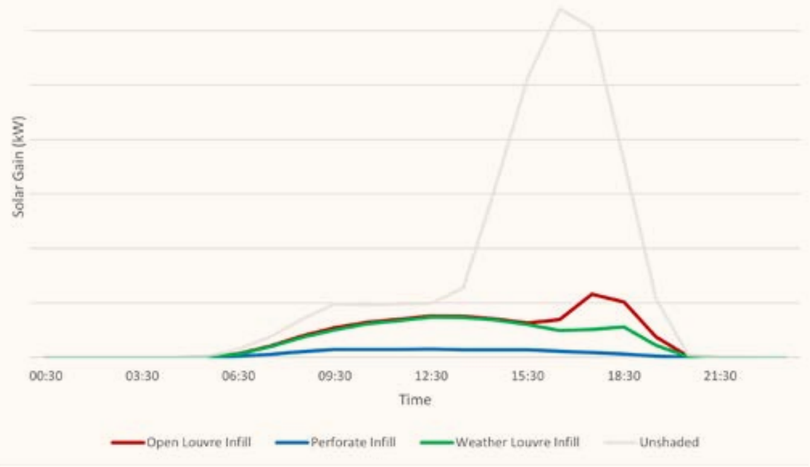


Product index
4, 5, 6, 7

This comparison of a shutter infill for a west-facing room shows a trade-off between solar shading, ventilation and daylight performance. Those showing the best degree of solar shading perform worse for daylight and ventilation when deployed.

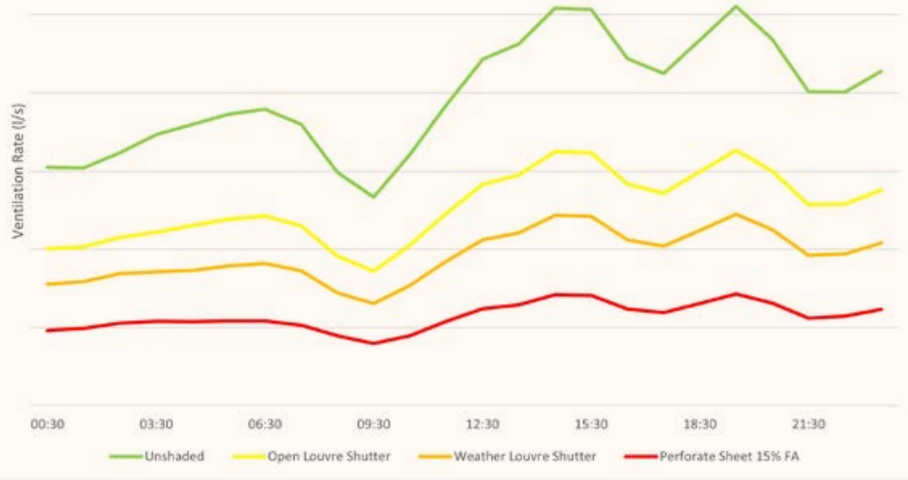
Though it should be noted that with the open louvre or perforate infill, there is still a risk of glare from the direct sun at low sun angles.

Infill comparison - solar gain



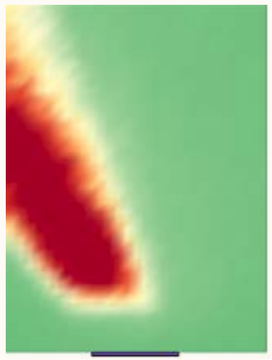
Shutters infill comparison - peak summer day, west facing room

Infill comparison - ventilation



External shutter infill comparison - typical summer day natural ventilation

Daylight factor images – sunny sky



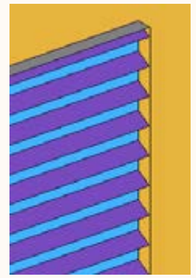
'Open Louvre' infill (contrasol linear 55) daylight lux plot, sunny sky

'Weather Louvre' Infill (Contrasol 40Z) daylight lux plot, sunny sky

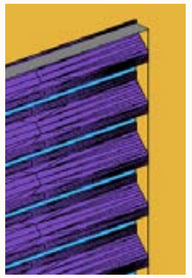
'perforate' infill (contrasol perforated - approx 15%) daylight lux plot, sunny sky

Contour scale/legend for lux plots sunny sky

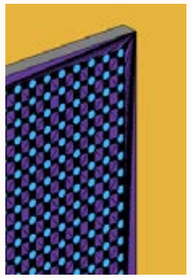
Shutter Infills



Open Louvre



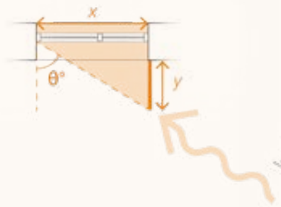
Weather Louvre



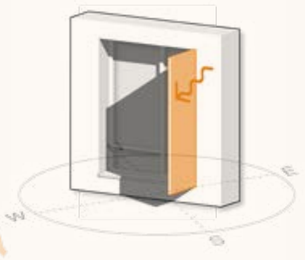
Perforate

Product 3:
Vertical fins

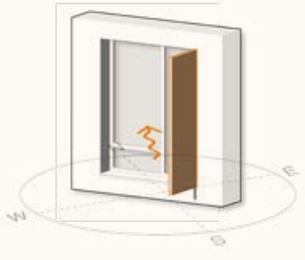
Product 3:
Vertical fins



Section



Summer



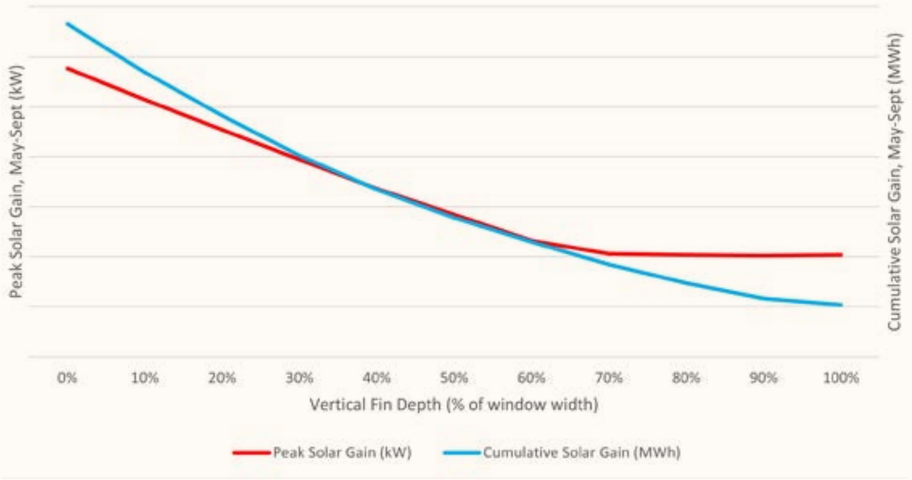
Winter

Product index
3

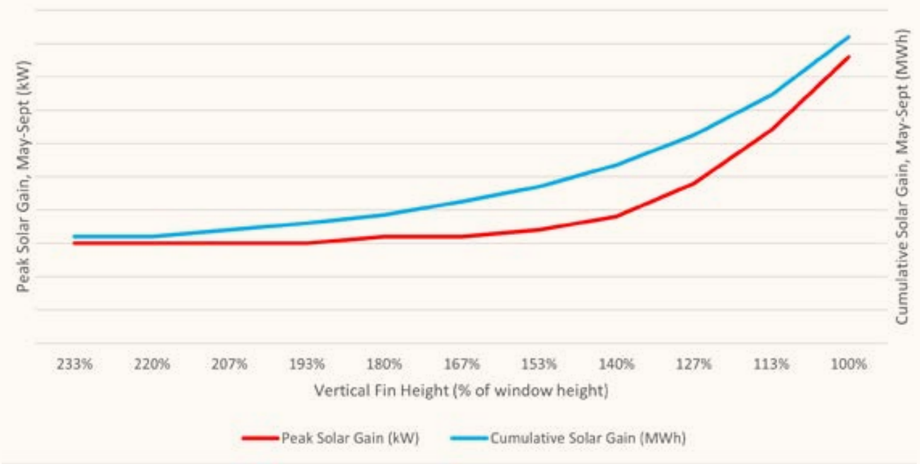
Dimensions (for west facing room): For peak solar gain, clear points beyond which diminishing returns are achieved can be observed. For cumulative solar gain, it is less clear cut.

Orientation: As can be seen, fins only provide a significant reduction in peak solar gain at a NE or NW orientation, although their reduction of cumulative solar gain is fairly uniform at all orientations.

Dimensional optimisation

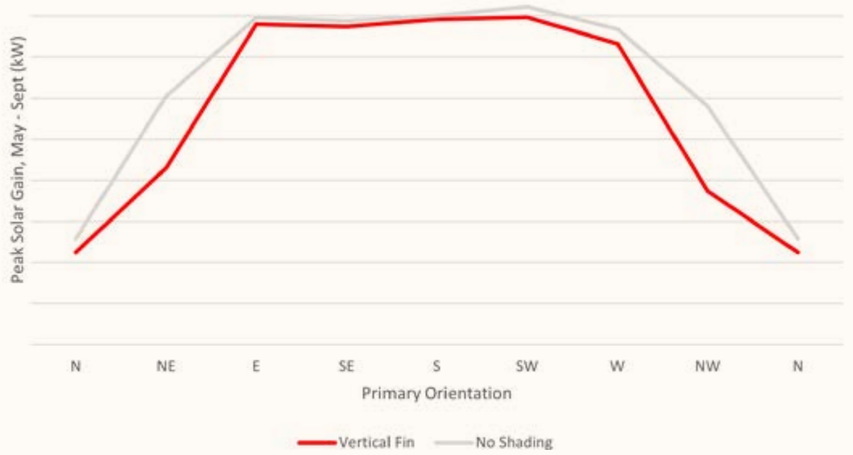


Effect of vertical fin depth on peak and cumulative solar gain



Effect of vertical fin height on peak and cumulative solar gain

Orientation effects



Effect of vertical fin shading with orientation - peak

Effect of vertical fin shading with orientation - cumulative

Product index
3

Annual efficacy: (for west facing room): As can be seen, some reduction in direct sun is observed through the summer afternoons, however there is also significant reduction of potentially useful winter solar gain.

Daylight: Depending on the sky condition, finish and location of the fin, the effect on daylight is variable. In general, assuming a light-coloured fin and an overcast sky, only a small reduction is observed, and due to reflections from the fin, distribution is slightly skewed.

Annual efficacy

Unshaded - West Facing

Month	Time 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Jan						0	0	0	0	100	100	100	100				
Feb					0	0	0	0	0	100	100	100	100	100			
Mar				0	0	0	0	0	0	100	100	100	100	100			
Apr			0	0	0	0	0	0	0	100	100	100	100	100	100		
May		0	0	0	0	0	0	0	100	100	100	100	100	100	100	100	
Jun	0	0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100
Jul		0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	100
Aug		0	0	0	0	0	0	0	0	100	100	100	100	100	100	100	
Sep			0	0	0	0	0	0	100	100	100	100	100	100	100		
Oct				0	0	0	0	0	100	100	100	100	100				
Nov					0	0	0	0	100	100	100	100	100				
Dec						0	0	0	100	100	100	100					

Annual efficacy of unshaded case

Vertical Fin - West Facing

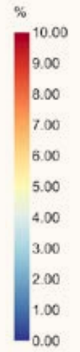
Month	Time 04:00	05:00	06:00	07:00	08:00	09:00	10:00	11:00	12:00	13:00	14:00	15:00	16:00	17:00	18:00	19:00	20:00
Jan						0	0	0	0	0	0	41	63				
Feb					0	0	0	0	0	0	5	46	67	81			
Mar				0	0	0	0	0	0	5	24	57	75	88			
Apr			0	0	0	0	0	0	0	17	46	70	85	97	100		
May		0	0	0	0	0	0	0	31	32	60	79	93	100	100	100	
Jun	0	0	0	0	0	0	0	0	0	43	64	82	95	100	100	100	100
Jul		0	0	0	0	0	0	0	0	38	60	79	93	100	100	100	100
Aug		0	0	0	0	0	0	0	0	23	50	73	88	99	100	100	
Sep			0	0	0	0	0	0	9	9	41	66	82	94	100		
Oct				0	0	0	0	0	2	2	33	61	77				
Nov					0	0	0	0	0	0	23	53	71				
Dec						0	0	0	0	0	10	45					

Annual efficacy of shaded case

Daylight factor images – overcast

Unshaded daylight factor plot

Daylight factor image of room with vertical fin



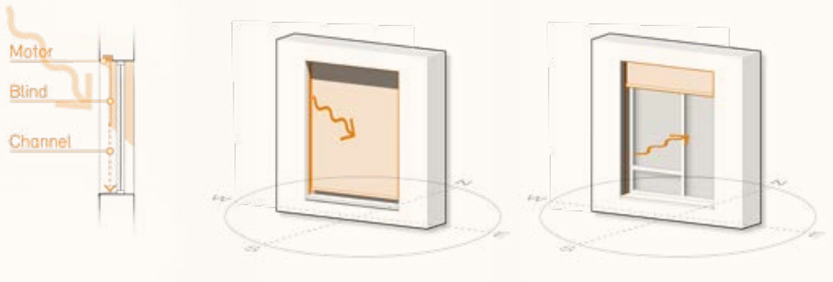
Contour scale/legend for daylight factor plots

Product 9:
External roller blinds

Product 10:
External roller shutters

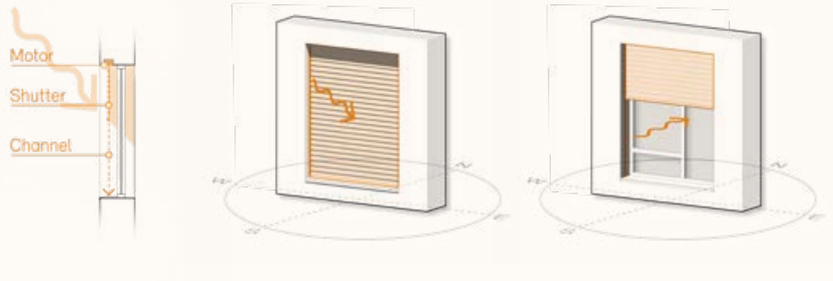
All products consisting of a continuous solid plane of shade extended in front of the window have been grouped together, as their performance is measured in a similar way with the main factor being the material, which can vary greatly.

Product 9:
External roller blinds



Section Summer Winter

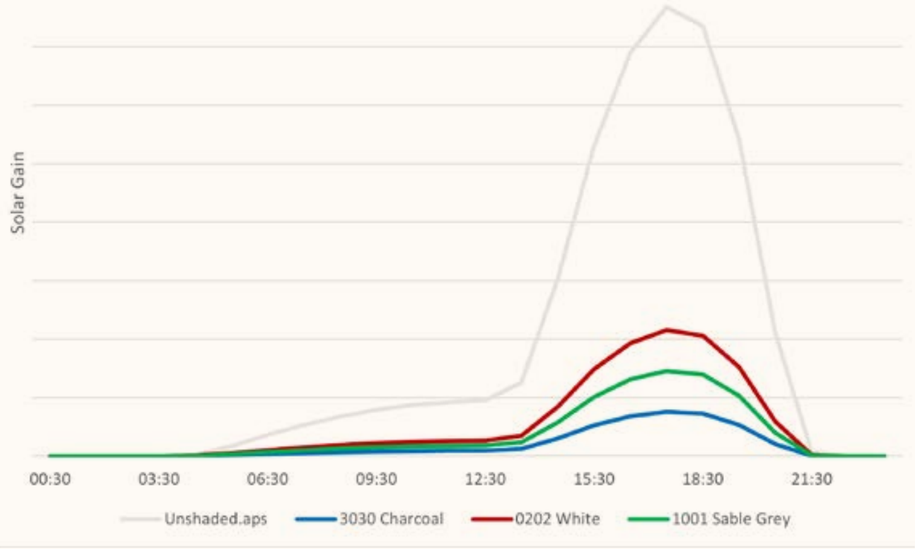
Product 10:
External roller shutters



Product index
9, 10

Material comparison: Similar to a shutter infill, there is a trade-off between shading performance and daylight with light fabrics still able to provide reasonable daylight when deployed to block direct sun. For darker fabrics it is likely that artificial lighting will be required if all blinds are deployed, so consideration should be given to the degree of blackout required.

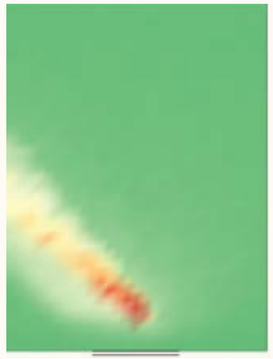
Material comparison - solar gain



External roller blinds - material comparison peak summer day

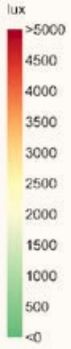
Daylight illuminance images - sunny sky

Daylight lux plot (sunny sky) 0202 White material external roller blind



Daylight lux plot (sunny sky) 1001 Sable Grey material external roller blind

Daylight lux plot (sunny sky) 3030 Charcoal material external roller blind



Contour scale/legend for lux plots sunny sky

Product index

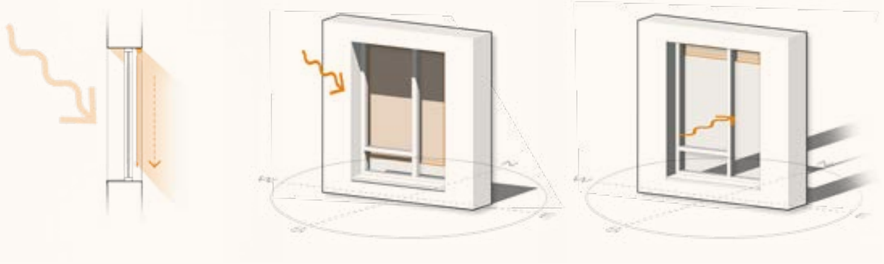
Product 14:
Internal roller blinds

Product 15:
Internal venetian blinds

Product 16:
Internal hinged shutters

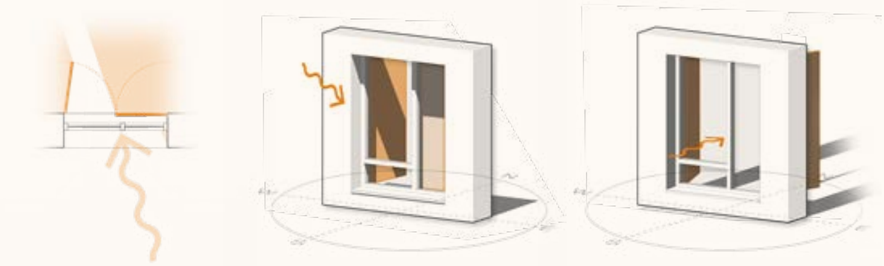
All internal shading products have been grouped together and compared against their external counterparts.

Product 14:
Internal roller blinds

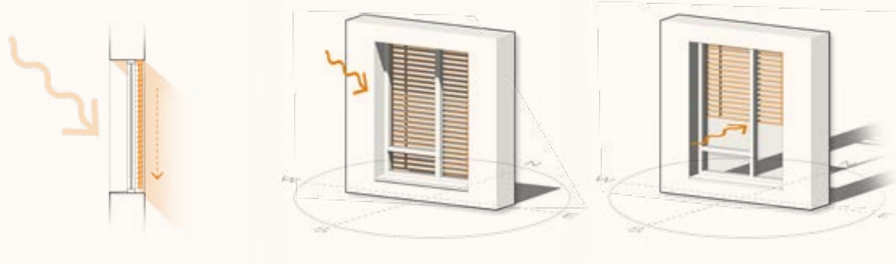


Section Summer Winter

Product 16:
Internal hinged shutters



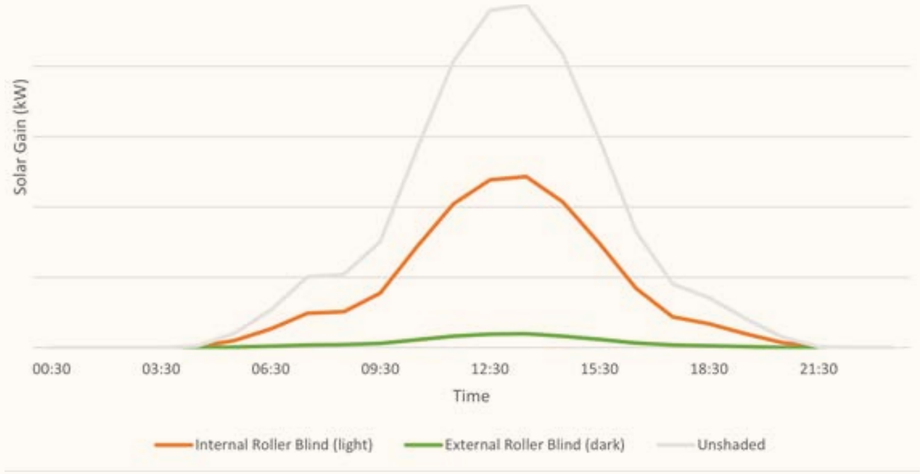
Product 15:
Internal venetian blinds



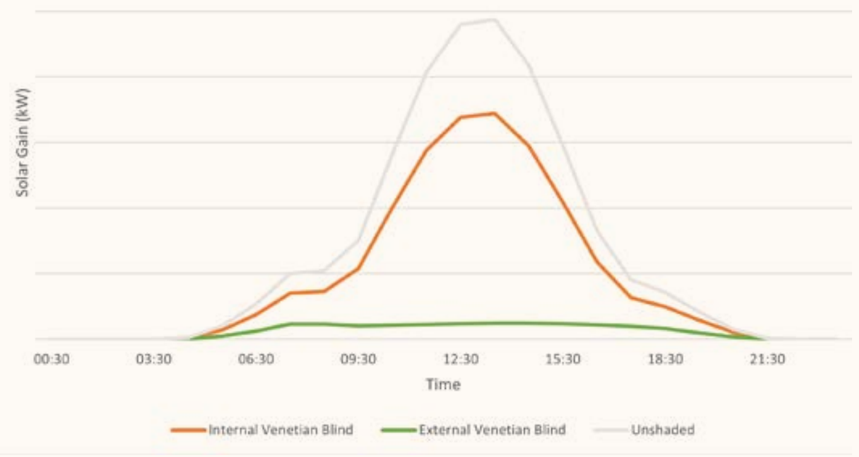
Product index
14, 15, 16

Internal vs External comparison: The graphs demonstrate the advantages gained by locating shading products outside. Rather than increased direct transmittance, the increase in solar gain results primarily from heat absorbed by the device and re-radiated to the room. For shutters and Venetian blinds the same product has been modelled inside and out. For roller blinds, a light coloured fabric has been used inside and dark outside, as would generally be recommended to minimise this effect.

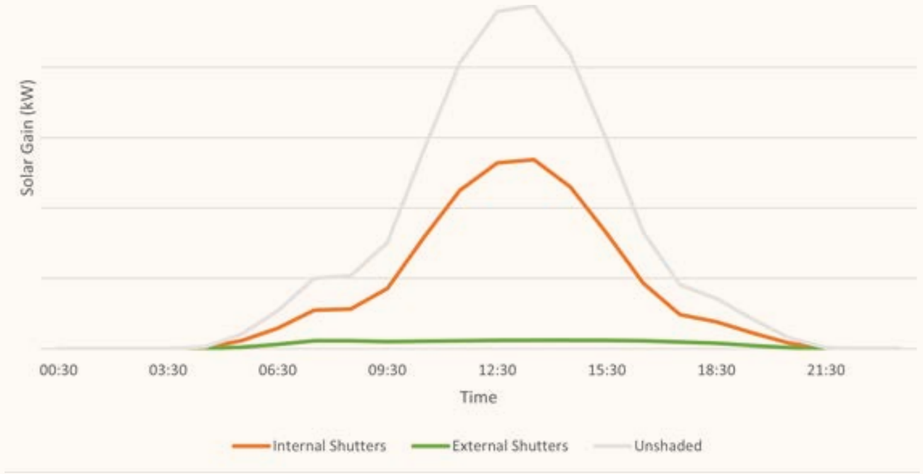
Internal vs External Comparison graphs



Internal vs External roller blinds - typical summer day



Internal vs External venetian blinds - typical summer day



Internal vs External shutters - typical summer day

Resources

Sponsor case studies and image galleries

Ballymore

Caribbean Blinds

Guthrie Douglas

Louvolite

Manufacturers

Caribbean Blinds UK Ltd - External blinds, louvered pergolas and awnings

Guthrie Douglas - Internal/external blinds and pergolas/sails

Louvolite - Internal blinds and shutters

Hallmark Blinds - External and internal venetian and roller blinds

Enviroblinds - External roller shutters and blinds

Contrasol - External shutters, brise soleil, horizontal slats, vertical fins

Cadisch MDA - Fixed screens, overhangs

S:CRAFT - Internal blinds and shutters

SmartLouvre - Metal fabric

Useful guides

European solar shading database – European Solar Shading Organisation

Solar shading impact report – National Energy Foundation

Solar shading for low energy and healthy buildings, 2018 edition 2 - European Solar Shading Organisation

Overheating in new homes - Good Homes Alliance

Overheating in retrofit and existing homes - Good Homes Alliance

Addressing overheating risk in existing UK homes - ARUP

Daylight analysis - Urban Light Surveyors

Embodied carbon of shading products - Pollard Thomas Edwards

Tools

Equa - Dynamic indoor climate and energy simulation software

EnergyPlus - Whole building energy simulation software

Radiance - Lighting simulation software

Endnotes

1. Nikolaos Christidis, Gareth Jones, Peter A Stot, *Dramatically increasing chance of extremely hot summers since the 2003 European heatwave*, Nature, published 08 December 2014; retrieved online September 2023
2. https://www.reuters.com/world/uk/england-had-4500-heat-related-deaths-during-record-breaking-2022-official-data-2023-09-22; retrieved online September 2023
3. ARUP, *Addressing overheating risk in existing UK homes* (2022) An Arup report commissioned by the Climate Change Committee; retrieved online September 2023
4. *Edwin Heathcote, 'The humble awning is ready for its time in the sun', Financial Times, 19 July, 2023*

Resources

Academic papers

Brown, C. (2023). Solar Shading Design and Implementation in UK Housing as a Tool for Advancing Sustainable Development. In The Role of Design, Construction, and Real Estate in Advancing the Sustainable Development Goals (pp. 63-83). Cham: Springer International Publishing.

Wright, A., & Venskunas, E. (2022). Effects of Future Climate Change and Adaptation Measures on Summer Comfort of Modern Homes across the Regions of the UK. Energies, 15 (2), 512.

Gupta, R., Howard, A., Davies, M., Mavrogianni, A., Tsoulou, I., Jain, N., Oikonomou, E. & Wilkinson, P. (2021). Monitoring and modelling the risk of summertime overheating and passive solutions to avoid active cooling in London care homes. Energy and Buildings, 252, 111418.

Lomas, K. (2021). Summertime overheating in dwellings in temperate climates.

Gupta, R., & Gregg, M. (2020). Assessing the magnitude and likely causes of summertime overheating in modern flats in UK. Energies, 13 (19), 5202.

Lavafpour, Y., Sharples, S., & Gething, B. (2020). The impact of building form on overheating control: a case study of Larch House. Architectural Science Review, 63(6), 467-480.

Grussa, Z. D., Andrews, D., Lowry, G., Newton, E. J., Yiakoumetti, K., Chalk, A., & Bush, D. (2019). A London residential retrofit case study: Evaluating passive mitigation methods of reducing risk to overheating through the use of solar shading combined with night-time ventilation. Building Services Engineering Research and Technology, 40 (4), 389-408.

Gupta, R. and Gregg, M. (2018) Assessing energy use and overheating risk in net zero energy dwellings in UK. Energy and Buildings, 158, 897-905

Gupta, R., Gregg, M. and Williams, K. (2015): Cooling the UK housing stock post-2050s, Building Services Engineering Research & Technology, 36 (2), 196-220

Mavrogianni, A., Davies, M., Taylor, J., Chalabi, Z., Biddulph, P., Oikonomou, E., Das, P. & Jones, B. (2014). The impact of occupancy patterns, occupant-controlled ventilation and shading on indoor overheating risk in domestic environments. Building and Environment, 78, 183-198.

Gupta, R, and Gregg, M (2013) Preventing the overheating of English suburban homes in a warming climate, Building Research and Information. 41:3, 281-300.

Gupta, R and Gregg, M (2012) Using UK climate change projections to adapt existing English homes for a warming climate. Building and Environment. 55, 20-42.

Resources

Standards and guidance

BS EN 13561 - External blinds and awnings. Performance requirements including safety

BS EN 13659 - Shutters and external venetian blinds. Performance requirements including safety

BS EN 14501 - Blinds and shutters. Thermal and visual comfort. Performance characteristics and classification

BS EN 52022-1 - Energy performance of buildings. Thermal, solar and daylight properties of building components and elements - Simplified calculation method of the solar and daylight characteristics for solar protection devices combined with glazing

BS EN 52022-3 - Energy performance of buildings. Thermal, solar and daylight properties of building components and elements - Detailed calculation method of the solar and daylight characteristics for solar protection devices combined with glazing

BS EN 13120 - Internal blinds. Performance requirements including safety

ISO 15099 - Thermal performance of windows, doors and shading devices

BS EN 17037 - Daylight of buildings

CIBSE TM 37 - Design for improved solar shading control

CIBSE TM 52 - Limits of thermal comfort: avoiding overheating in European buildings

CIBSE TM 59 - Design methodology for the assessment of overheating risk in homes

CIBSE TM 69 - Dynamic thermal modelling of basic blinds

CIBSE - Guide A - Environmental design

CIBSE - Guide F - Energy efficiency in buildings

Solar shading for low energy buildings, 2012

TN 72 - External shading devices

BRE - Summertime performance of windows with shading devices (2005)

BRE - Solar shading of buildings: Second edition (BR 364)

BRE - Site layout planning for daylight and sunlight: a guide to good practice (BR 209, 2022 edition)

GLA London Plan 2021 - Policy SI4 - Managing heat risk

NPPF - planning policy - Climate change planning policy ch 14 – Meeting the challenge of climate change, flooding and coastal change

Approved documents:

Part B - Fire Safety

Part F - Ventilation

Part L - Conservation of fuel and power

Part O - Overheating

Part Q - Security in dwellings

Credits and acknowledgements

Authors:

Joseba Perez de Larraya, Raffaella Corrieri, Tom Dollard, Rory Olcayto, Grecia Castillo, Heike Messler, Pollard Thomas Edwards

Kai Salman-Lord and Will Curwen, Max Fordham

Rajat Gupta, Oxford Brookes University

Chris Martin, Martin Arnold

Editor: Rory Olcayto, Pollard Thomas Edwards

Technical editor: Joseba Perez de Larraya, Pollard Thomas Edwards

Design: Tim Metcalfe, Pollard Thomas Edwards

Illustrations: Joseph Stancer, Pollard Thomas Edwards

The authors would like to thank Good Homes Alliance, British Blind and Shutter Association, Ballymore, Caribbean Blinds, Guthrie Douglas and Louvolite for sponsoring and supporting the publication of this guide. Thank you to the steering group and focus group participants and all the architects and photographers who have contributed to the guide.

Steering group:

Andrew Chalk, British Blind and Shutter Association
Dave Bush, British Blind and Shutter Association
Zoe De Grussa, British Blind and Shutter Association
Julian Brooks, Good Homes Alliance
Richard Broad, Good Homes Alliance
Aaron Caffrey, Ballymore
Bryn Marler, Ballymore
Stuart Dantzic, Caribbean Blinds
Andrew Kitching, Guthrie Douglas
Steve Birtles, Louvolite
Adrian Coe, Urban Light Surveyors
Anastasia Mylona, The Chartered Institution of Building Services Engineers (CIBSE)
Belen Alemany, Energy Conscious Design Architects (ECD)
Debbie Haynes, OxPlace
Emma Davies, Greater Cambridge Shared Planning Service
Gregory Francis, Urban Light Surveyors
Neil Murphy, TOWN
Nicholas Heath, NDM Heath Ltd
Richard Young, Sovereign
Seb Laan Lomas, Architype

Photography credits:

cover - Oxbourne House, Fletcher Priest Architects © Jack Hobhouse
Goldsmith Street passivhaus, Mikhail Riches © Tim Crocker; p12
Villa Caroisla, Nick Baker Architects © Hamish Par; p13
Hampshire Passivhaus, Ruth Butler Architects © Peter Langdown Photography; p14
Colby Lodge, Pollard Thomas Edwards © Tim Crocker; p15
Hanham Hall, HTA © Nick Harrison; p16
Oxbourne House, Fletcher Priest Architects © Jack Hobhouse; p17
Sliema Palazzino © Architecture XV; p18
Camden passivhaus, Bere Architects © Tim Crocker; p19
External roller blinds © Caribbean Blinds; p20
Central Somers Town, Adam Khan Architects © David Grandorge; 21
Jolles House, Pollard Thomas Edwards © Simon Taylor; p25
Beechwood Village, Pollard Thomas Edwards © Nick Kane; p26
The Avenue, Pollard Thomas Edwards © Tim Crocker; p29
Diespeker Wharf, Pollard Thomas Edwards © Simon Kennedy; p30

Shading for housing

Design guide for a changing climate

Contact

Richard Broad
Projects & Communications Manager
Good Homes Alliance

richard@goodhomes.org.uk
0330 355 6275

Andrew Chalk
Director of Operations
British Blind and Shutter Association (BBSA)

andrew@bbsa.org.uk
01449 780 444

Delivered by

Pollard Thomas Edwards with MAX FORDHAM, Oxford Brookes University, MA Martin Arnold

Commissioned by

Good Homes Alliance, BBSA British Blind & Shutter Association

Supported by

ballymore., Guthrie Douglas, LOUVOLITE, Caribbean Blinds UK LTD