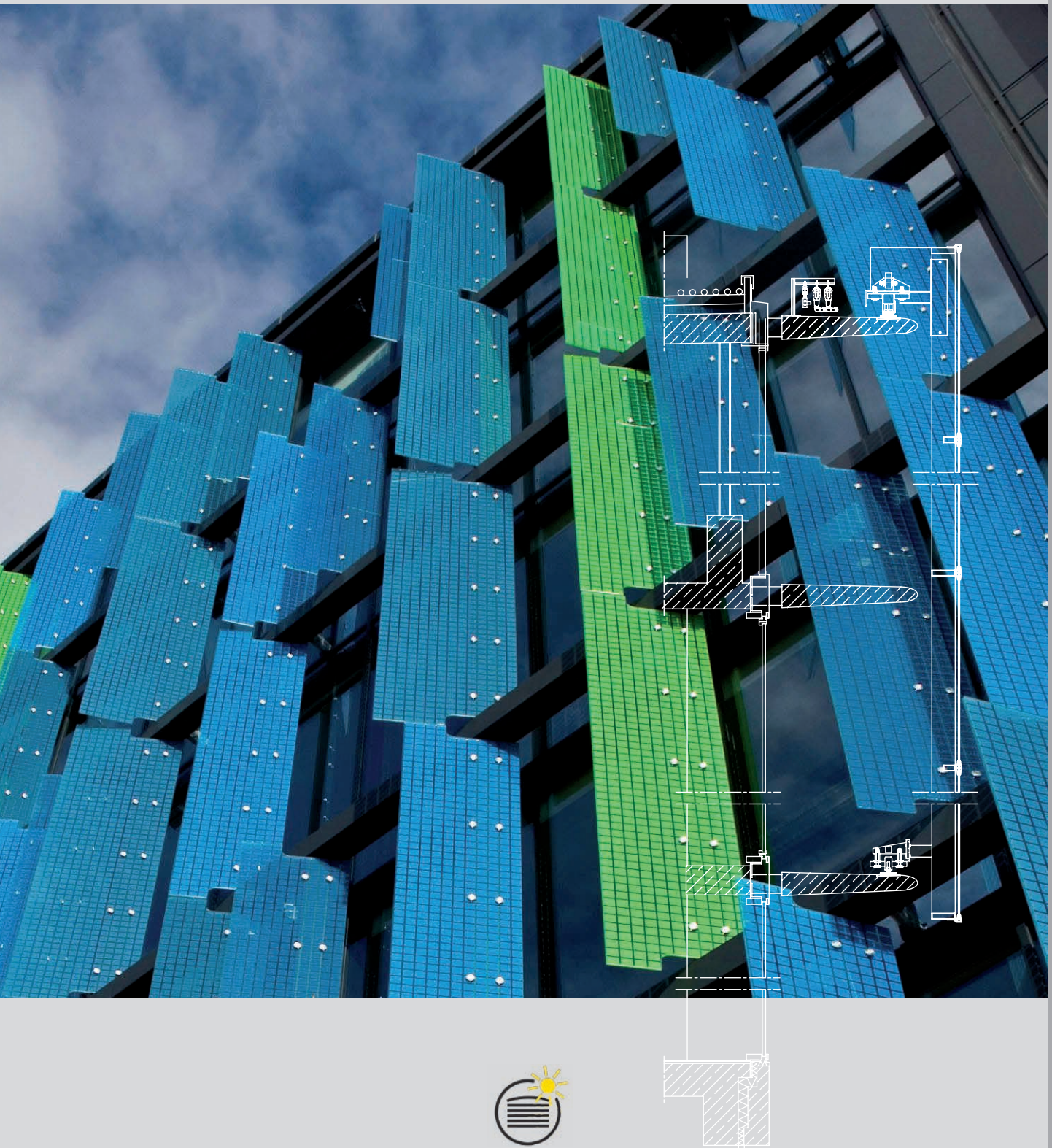




Maximising energy performance and productivity with solar shading



FRONT COVER IMAGE

Severn Trent Water Authority, Coventry.
Laminated, fritted, controllable glass louvres.

COLT SOLAR SHADING SYSTEMS

Solar shading, daylight optimization and energy reduction





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Shading, daylight optimisation and energy saving

THE NEW ROLE OF THE FACADE

The building envelope is undergoing a revolution. It can now be designed to do more than just to keep the weather out and to provide an impressive appearance: it can make a positive contribution in reducing the energy consumption of the building. Modern design approaches can turn the envelope into an active component through the use of solar shading systems.

This leaflet describes how Colt solar shading devices can be integrated into buildings and what they can achieve.

Colt solar shading systems can save energy

Solar shading systems have a great potential to impact on energy use and thereby to reduce the use of fossil fuels. Buildings use more than 40% of total energy resources, of which around half is used for heating and cooling.

Modern glazed commercial buildings have become very well insulated, so that less energy is required for heating them in winter. However, if no attention is paid to their shading requirements, they can use a lot more energy for cooling in summer than for heating in winter.

The ESCORP/EU25 study recently demonstrated that if all buildings in the EU were properly solar shaded, 80 million tonnes of CO₂ could be displaced for cooling and 31 million tonnes of CO₂ for heating every year.

Accordingly local building regulations increasingly require designers to reduce solar heat gain,

with solar shading recommended as a preventative measure unless areas of glass are minimised.

Colt solar shading systems can increase comfort and productivity

We can all appreciate the benefits of working in an environment where the temperature is comfortable. For office buildings in the summer, the optimum temperature is around 24°C, with a range of +/- 4°C.

If the building is fully glazed but does not have an effective solar shading system, the internal temperature can shoot up as high as 35°C during the hotter months, due to the effects of solar radiation.

Such an uncomfortably warm environment adversely affects the productivity and concentration levels of the occupants inside. In air conditioned buildings uncontrolled solar heat gain can increase cooling loads, plant size and overall running costs.

The amount and quality of natural daylight also has a positive effect on the productivity of the building's occupants. Independent studies have shown when people sit near a window, enjoying the benefits of natural daylight, their productivity significantly improves. A lack of daylight can also result in an over-use of artificial lighting, which in turn contributes to internal heat gain.

A well-designed shading system can boost the occupants' comfort and productivity by regulating the amount of heat and light entering the internal space and by reducing glare.

Colt solar shading systems can provide architectural impact

Solar shading systems can be designed so as to provide great architectural impact as well as being highly functional. Colt solar shading systems come in a great variety of materials. Glass, metal, wood, acrylic and fabric louvres are all available to architects to create an impressive facade. The louvres can be either fixed or moveable and also can integrate photovoltaic electricity generating cells.

Pictured in this leaflet are several buildings that feature solar shading systems designed and installed by Colt. These examples show how solar shading can create an impressive architectural impact while contributing to a comfortable internal environment and to the building's energy efficiency.

Why is external solar shading one of the most effective ways to control the internal conditions of a building?

Radiation from the sun is transmitted, absorbed and reflected by the louvres. As a result solar heat gain is prevented from passing into the building, minimising ventilation requirements and reducing cooling loads.

If a controllable system is installed, adjustable louvres track the position of the sun, thereby reducing the numbers of days when the building overheats. Equally, in winter the louvres may be adjusted in such a way that the building benefits from the heat from the sun, and they can be closed at night reducing heat loss. At the same time daylight levels are enhanced and levels of glare are reduced.

“ ”

Commercial buildings use more energy for cooling in summer than for heating in winter

Colt's wide range of solar shading systems and design expertise provides architects with the resources to develop the most effective solution for their building while creating a building of great architectural impact.

Features and benefits of external solar shading

Colt's external solar shading offers many benefits to the designers and occupiers of buildings:

- Sun protection
- Reduction of glare and quality of natural light
- Greater productivity and comfort
- Energy savings
- Lower cooling and heating needs
- Lower artificial lighting needs
- Energy generation using photovoltaic cells
- Control of ventilation when used with double façades
- Reduced noise ingress
- Aesthetic impact



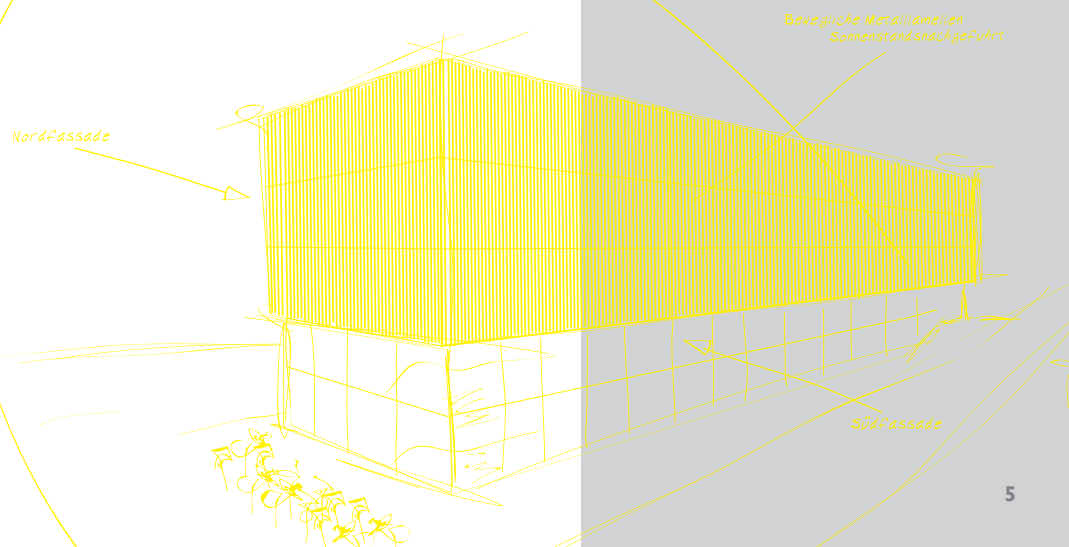
Trinity Square, Nottingham, UK



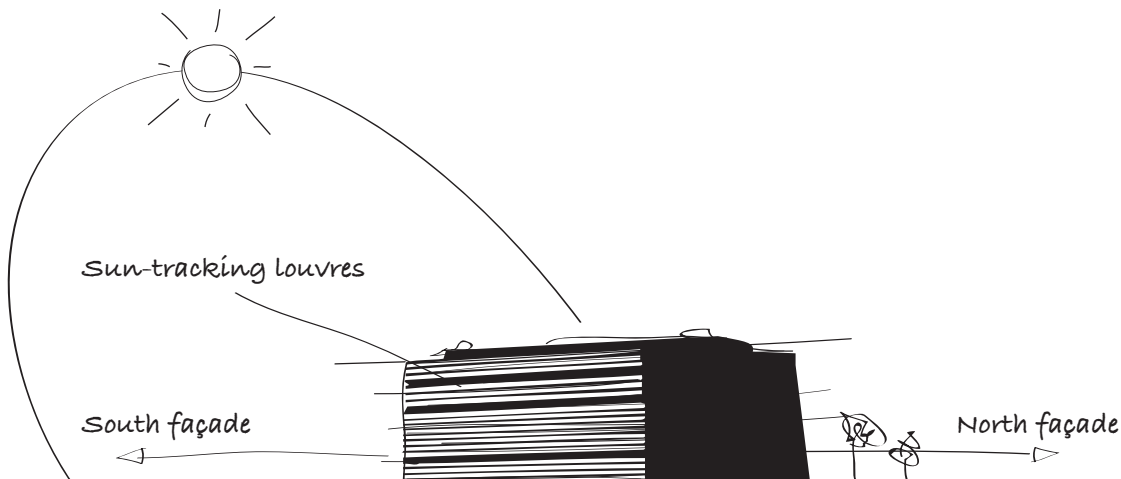
Strenesse store, Metzingen, Germany. Fixed Solarfin solar shading system designed for optimal solar shading.



Campus Krems, Austria. Moveable fabricated Shadometal louvres are 25% perforated and cover the complete façade in two elevations. At night the louvres are fully opened in order to provide night cooling. At 4 o'clock in the morning the louvres close to ensure that the complete building is shaded. In winter time the sun's rays passively warm the building and glare is reduced as the louvres track the sun.



Performing Buildings



This illustration shows how sun tracking solar shading works, with the louvres being moved by a sophisticated control system to track the sun.

ACTIVE FACADES, INCLUDING SOLAR SHADING, ARE BECOMING PART OF THE OVERALL BUILDING ENERGY MANAGEMENT STRATEGY

Expertly designed solar shading systems provide the maximum yield of light, heat and ventilation and also prevent unpleasant glare and overheating of the inside of the building, provided that the controls strategy has been carefully thought through.

Colt can advise on the different kinds of control routines. These include calendar driven or active routines, passive sun tracking routines, and routines which ensure that the movements of the louvres optimise the requirements for ventilation, air conditioning or photovoltaic energy generation.

MOVEABLE SHADING SYSTEMS PROVIDE A WIDE RANGE OF POTENTIAL BENEFITS

Energy-related benefits:

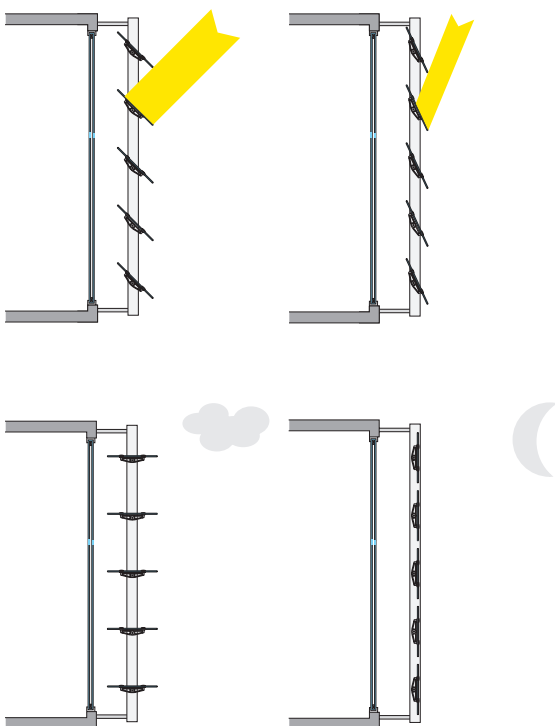
- Shading and reduction of cooling loads
- Night cooling
- Insulation of the building in winter
- Photovoltaic energy generation
- Controlled ventilation if the louvre system forms a secondary façade

Comfort-related benefits:

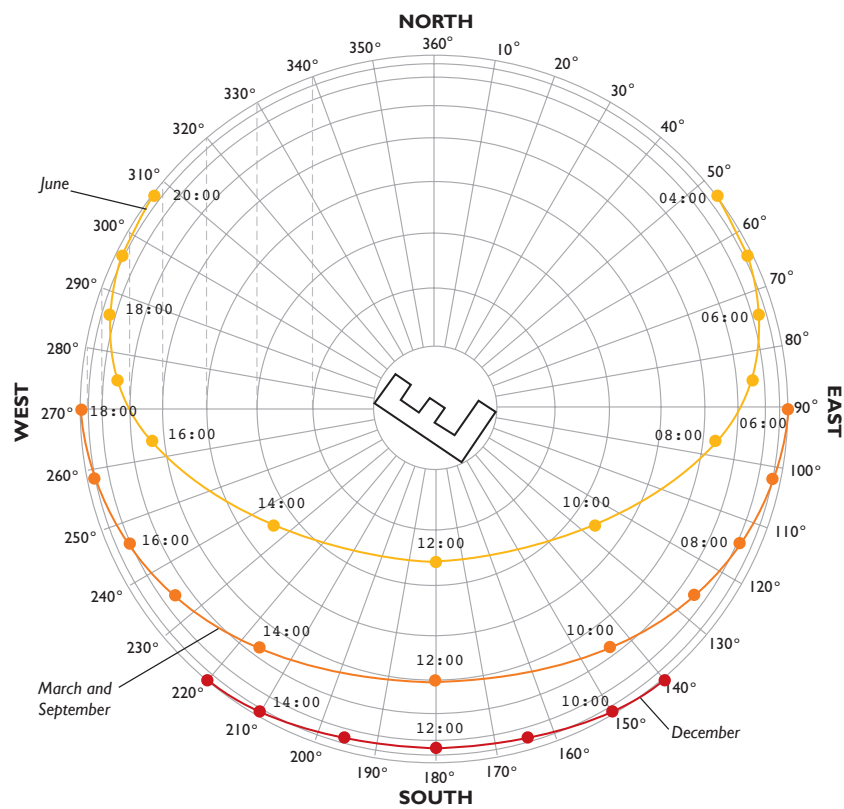
- Less glare
- Reflection of daylight
- Lower noise

Aesthetic benefits:

- A dynamic façade changes with the time, seasons and weather
- Good looks

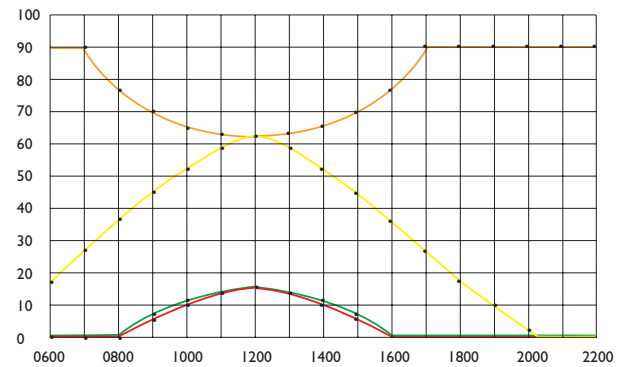


There are different strategies for tracking the sun. For instance, when it is overcast, daylight optimisation comes into play.

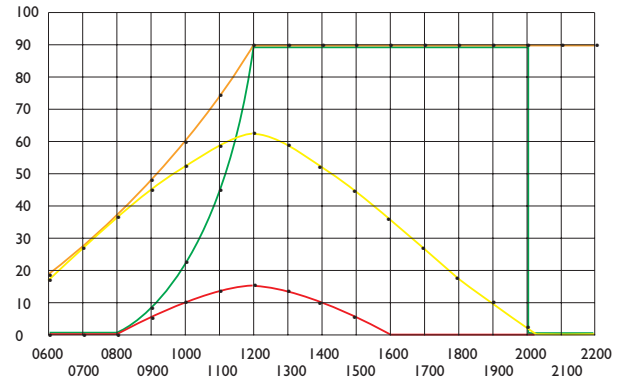


Notes: 1. When louvre angle $> 90^\circ$ - facade is in the shade. 2. Normally the angle of the louvre follows the VSA (vertical shadow angle). When shading is not required (i.e. when facade is in the shade or when the sky is overcast), the louvres may be set for maximum daylight entry or vision to the outside, or are closed for night security and improved insulation.

SOUTH FACADE



EAST FACADE



- Sun altitude in summer
- Sun altitude in winter
- Louvre angle in summer (June)
- Louvre angle in winter (December)

City of Westminster College, London
Polycarbonate vertical solar shading system.





The Old Pumping Station in Berlin, Germany. Extraordinary impact caused by the juxtaposition of older and newer architecture.

Glass louvres make the building transparent in a controlled fashion

Colt Glass Louvre Systems



Alstertal Shopping Centre in Hamburg. 809 coloured back-lit adjustable glass louvres emphasize the living character of the urban quarter



Holocaust Museum in Budapest, Hungary. This building, designed by Daniel Libeskind, has attracted a lot of attention.



Galizia Fashion Store, Metzingen, Germany. Aesthetics and functionality perfectly combined.

GLASS: HIGH ENERGY PERFORMANCE, MORE LIGHT AND VISIBILITY

Glass louvres can be extremely desirable as a solar shading element for façades. They reflect and absorb the sun's rays but at the same time allow plenty of daylight to come through, and allow good outward vision. Glass also looks good on buildings: glass can reduce the monolithic appearance of buildings.

There are many different types of glass available: glass may either be tinted, fritted or have a foil attached to it, in order to achieve the control the precise amount of daylight and solar radiation entering the building. Glass louvred systems such as Shadoglass also permit the building to be warmed by the sun in winter.



Nycomed Office Building in Konstanz, Germany. Impressive visual appeal combined with excellent performance. The building envelope consists of an active façade consisting of moveable glass louvres which provide solar shading and defence against inclement weather. The glass louvres have a 60% frit to reduce the solar heat gain but allow enough light to come through. The blades are continuously moving to their optimum positions and those inside keep an excellent view to the exterior.



Foto: © Taurik Kenan



Beckenham Beacon, Bromley.



Carphone Warehouse, Manchester.



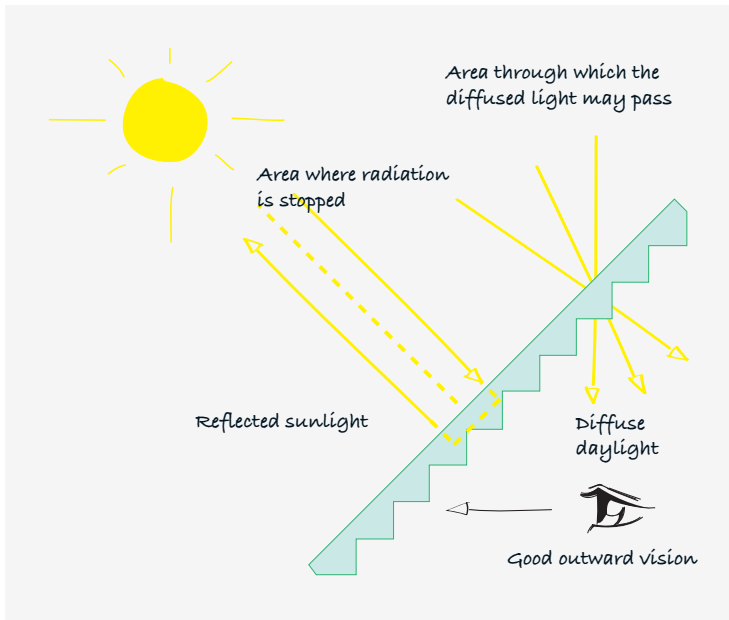
© paul ott photographiert

Optimum solar shading and glare reduction with prism louvres

Colt Prism Louvres

Hospital in Linz, Austria. 2,160 moveable prism louvres ensure that there is excellent light quality within the building.

The illustration below shows how when light strikes the face of a saw tooth prism louvre at 90°, direct light is reflected but diffused light is allowed through.



This shows a detail of the structure of a prism louvre. The louvres themselves are made from highly transparent PMMA plexi-glass, which is UV and weather resistant.

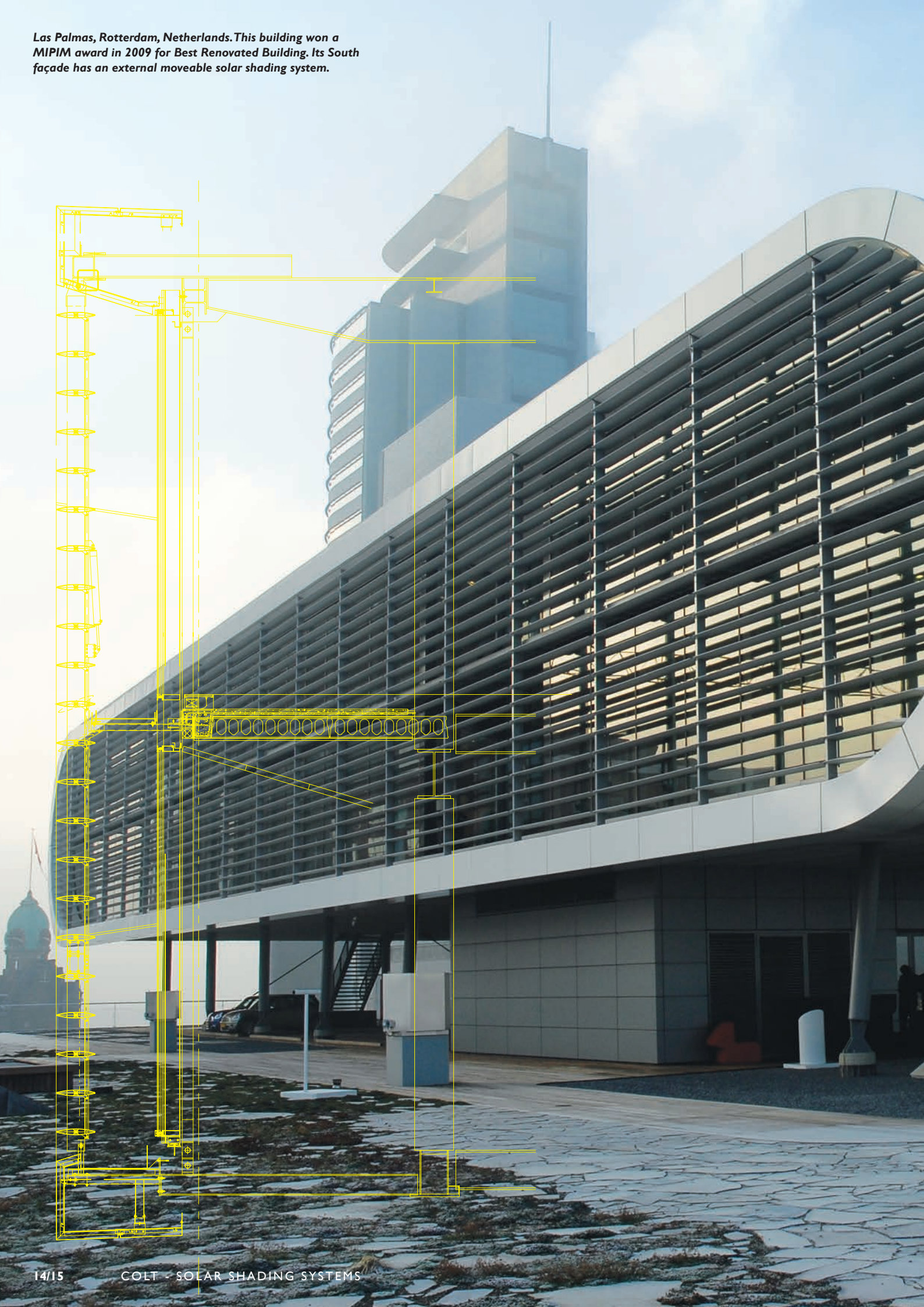


TRANSPARENT SOLAR SHADING

Prism louvres are easy to integrate into many different types of façades and roofs. Optimum efficiency is achieved if the prism louvres are moved to a precise position to follow the changing position of the sun.

Prism louvres reflect direct light and its associated heat but allow diffused light through which means that the building is pleasantly lit by natural daylight with a good outward vision, at the same time as solar heat gains are reduced.

Las Palmas, Rotterdam, Netherlands. This building won a MIPIM award in 2009 for Best Renovated Building. Its South façade has an external moveable solar shading system.



Papago Gateway Centre, Arizona USA. Shading analysis shows that the motorized sun shading helps reduce energy onto the façade by 73% at peak, and that energy entering the building reduces by 92%. The analysis also shows an expected reduction in cooling load of 21%.



Tilak Competence Centre, Innsbruck, Austria. 964 moveable louvers comprising an area of 2925m² of solar shaded façade.

Metal louvre cladding systems offer a sensitive aesthetic

Colt Metal Louvre Systems

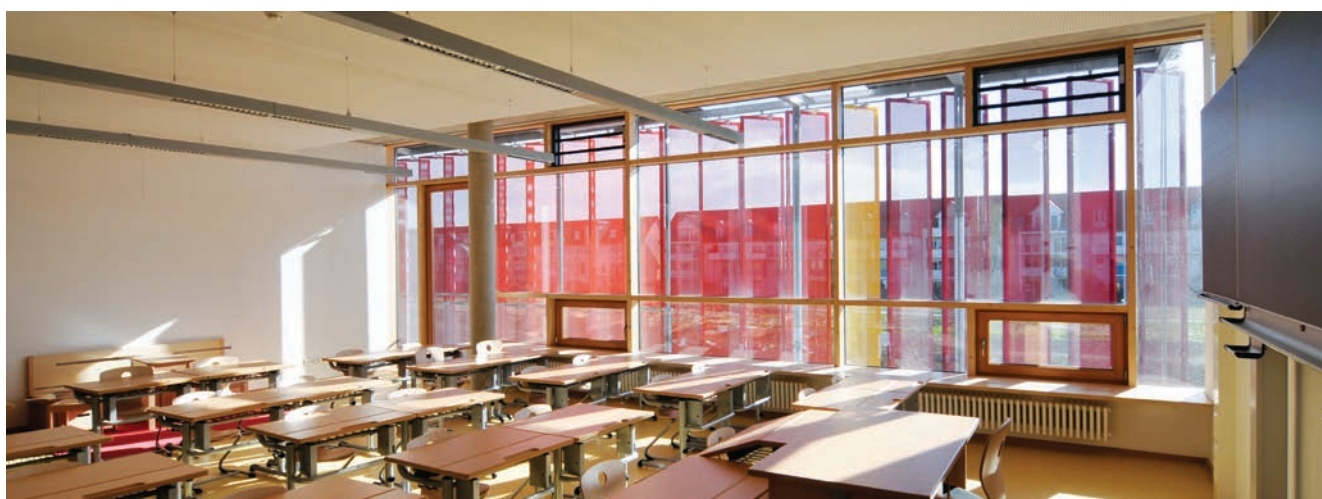
COLT BRINGS STRUCTURE TO THE BUILDING ENVELOPE

Metal louvers can provide outstanding control of daylight and reduce solar heat gain. They can be either extruded or fabricated, and also can be perforated. They are often the louvre type of choice for offices, schools and sports facilities. They can be positioned either horizontally or vertically and maybe either fixed or moveable.

Perforated metal louvers allow precise control over the amount of heat and light entering the building, and also influence the quality of outward vision.

Metal louvre systems are available either in anodised aluminium, polyester powder aluminium to a RAL colour or stainless steel. Metal louvre systems can place little weight on the building.

Included in the Colt product range is a C-section aluminium fin which may be adjusted on site in 15° graduations to the correct angle. Other Colt metal louvre systems provide both shading and natural ventilation with excellent weather protection.



All images on pages 16 and 17: School at Neubiberg, Germany.



School at Neubiberg, Germany. Colourful louvres bring the school to life. The louvres are perforated and lead to a light airy interior.

Colt calculated the sun path and sun angles required to provide effective solar shading as well as the solar heat gains.

Architect Gundel Krug from Munich says, "Since the louvres are from floor to ceiling, this seems to make the entire building float on air; they give the school a welcoming face and all the pupils and teachers are very satisfied with the effects".

The louvres on the North façade are fixed but on the South, West and East façade they are moveable, tracking the sun and divided into 22 different groups. Each group reflects the requirements of the particular inside space and has a different controls approach. It is possible to override the controls manually.





Milsertor House, in Hall, Austria. Plexiglass folding shutters provide an appearance of flags hanging off the building, whilst providing excellent solar shading and good outward vision.

An individual approach with Colt sliding and rotating shutter systems

Colt sliding and rotating shutter systems

University of Potsdam, Germany. Gold anodised vertically folding shutters which open and closed according to the position of the sun.



Sliding shutters at Q-Cells, Bitterfeld, Germany. These shutters incorporate photovoltaic cells and provide a striking aesthetic effect. The shutters move in accordance with the sun's position.



THE SKY'S THE LIMIT

Colt folding and sliding shutters are individually designed for each building. There are many different types of materials and colours. Sliding and folding shutters are a very flexible design element, which provide not only effective solar shading but also an effective design element which is dynamic and variable according to the weather situation.

Such systems can provide complete blackout through to diffuse light entry. This page shows some good examples of projects carried out with such systems and the individual design capability of Colt.

“ ”

Tests in our own wind tunnel have enabled us to optimise the designs of solar shading systems.

“ ”

Colt solar shading systems:
a synthesis of quality, functionality
and fine design



Colt Solar Shading systems: a synthesis of quality, functionality and fine design

Colt special designs

ACHIEVING WHAT IS POSSIBLE AND UNCONVENTIONAL

Special requirements require special solutions. Colt can provide a range of special solutions to meet the customer's requirement.

How is this achieved? Colt has extensive test facilities to check what can be achieved, to see how far the design envelope can be extended.

The images on this and the following pages show some of the projects that Colt has delivered where special requirements have been met.

Willi-Beck Bakery, Switzerland. These louvres are installed from ground level up to the eaves and are made from spruce and fir, giving the building a unique character. The wood has a dark grey coloured iron oxide paint applied to them, which enables their appearance to change depending on the angle at which they are opened.



Ørestad Gymnasium, Copenhagen, Denmark. Many of the glass louvres are coloured crating a subtle effect inside the building.



Malvern Hills Science Park, UK. Textile Shadotex louvres provide effective shading of this award winning building.



Wesertal Expo Tower, Germany. This complete test building moves in accordance with the position of the sun and the seasons of the year.



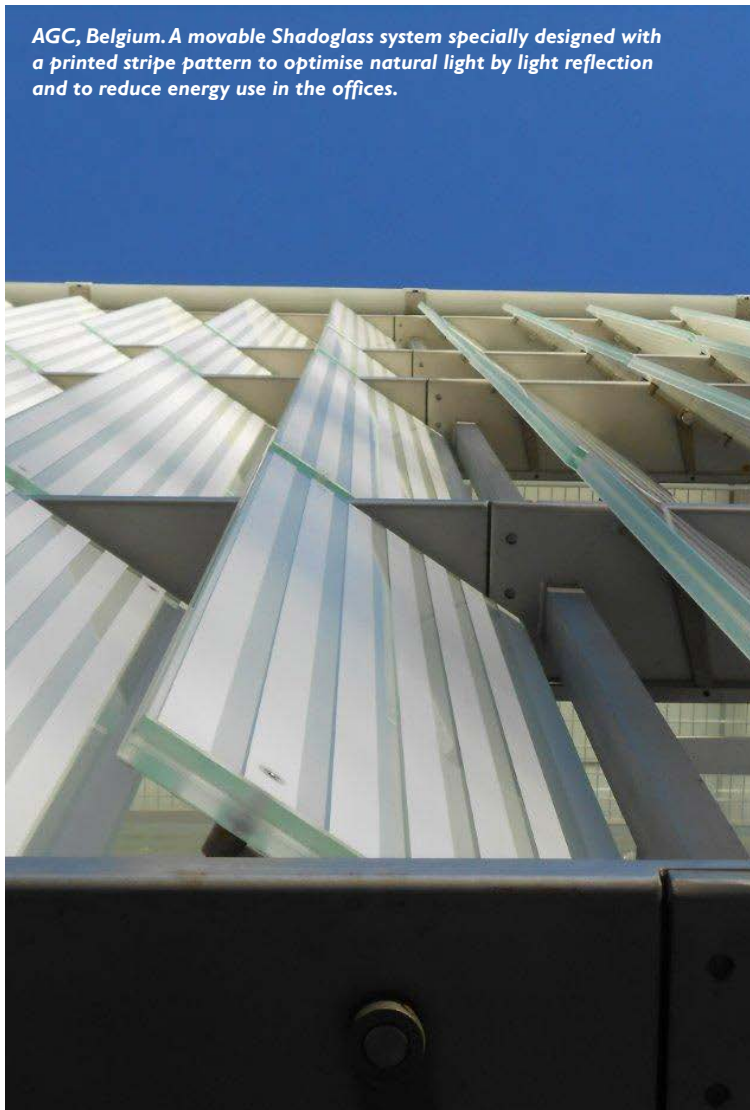
*Consolidated Forensics Laboratory, Washington DC, USA.
A controllable Shadoglass LS-2 system covers the south facade of the building as a louvre screen in 3 banks.*



Ørestad Gymnasium, Copenhagen, Denmark. Many of the glass louvres are coloured, creating a subtle effect inside the building.



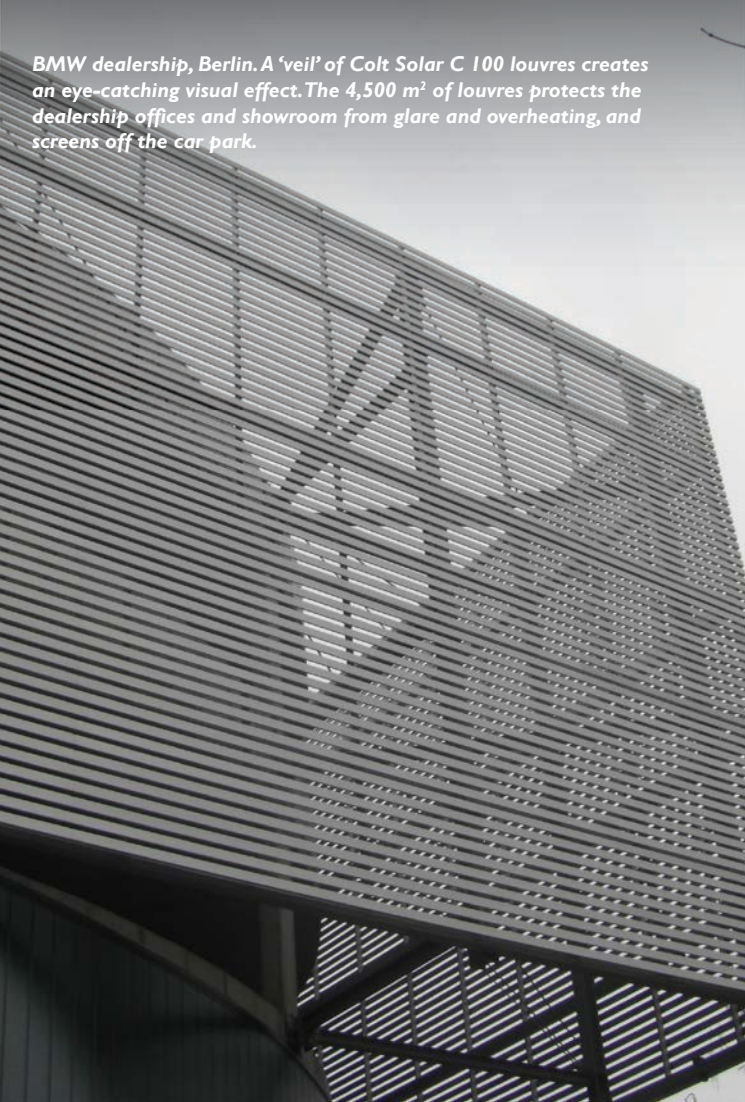
AGC, Belgium. A movable Shadoglass system specially designed with a printed stripe pattern to optimise natural light by light reflection and to reduce energy use in the offices.



SBB (Swiss Railway) Headquarters, Basel, Switzerland. Each louvre is made of two glass louvres with a metallic fabric in radiant gold, chrome, copper, pearl and aluminium finishes sandwiched in between. The 6,258 glass louvres provided by Colt cover the 9,134 m² of façade. Each façade and every bank of identical coloured louvres is individually controllable, creating an eye-catching pattern.



BMW dealership, Berlin. A 'veil' of Colt Solar C 100 louvres creates an eye-catching visual effect. The 4,500 m² of louvres protects the dealership offices and showroom from glare and overheating, and screens off the car park.



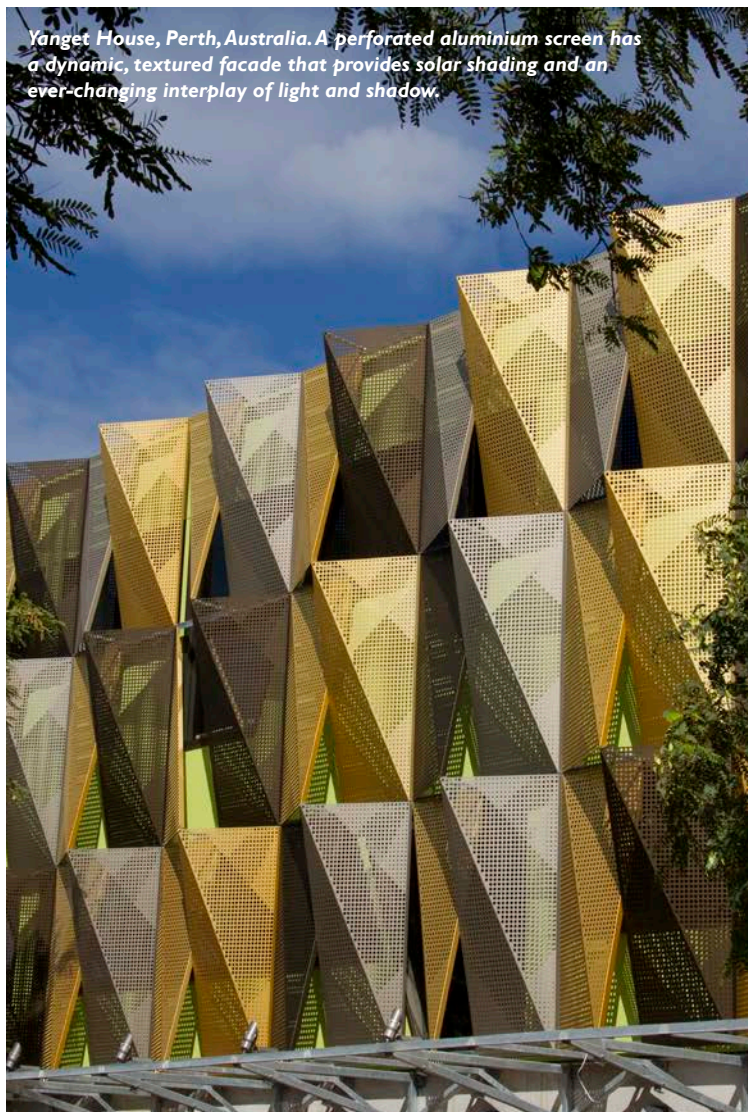
XTU, Paris. Shadoglass louvres protect the flats' balconies and can be manually opened to provide ventilation. They have segments printed in different shades of grey to create an eye catching pattern.



New Doha International Airport, Qatar. 11,400 m² of Shadoglass LS-4 louvre greatly reduce the solar heat gain into the building, thereby both enabling more comfortable conditions and reducing the amount of air conditioning used, thus reducing the building's running costs.



Yanget House, Perth, Australia. A perforated aluminium screen has a dynamic, textured facade that provides solar shading and an ever-changing interplay of light and shadow.





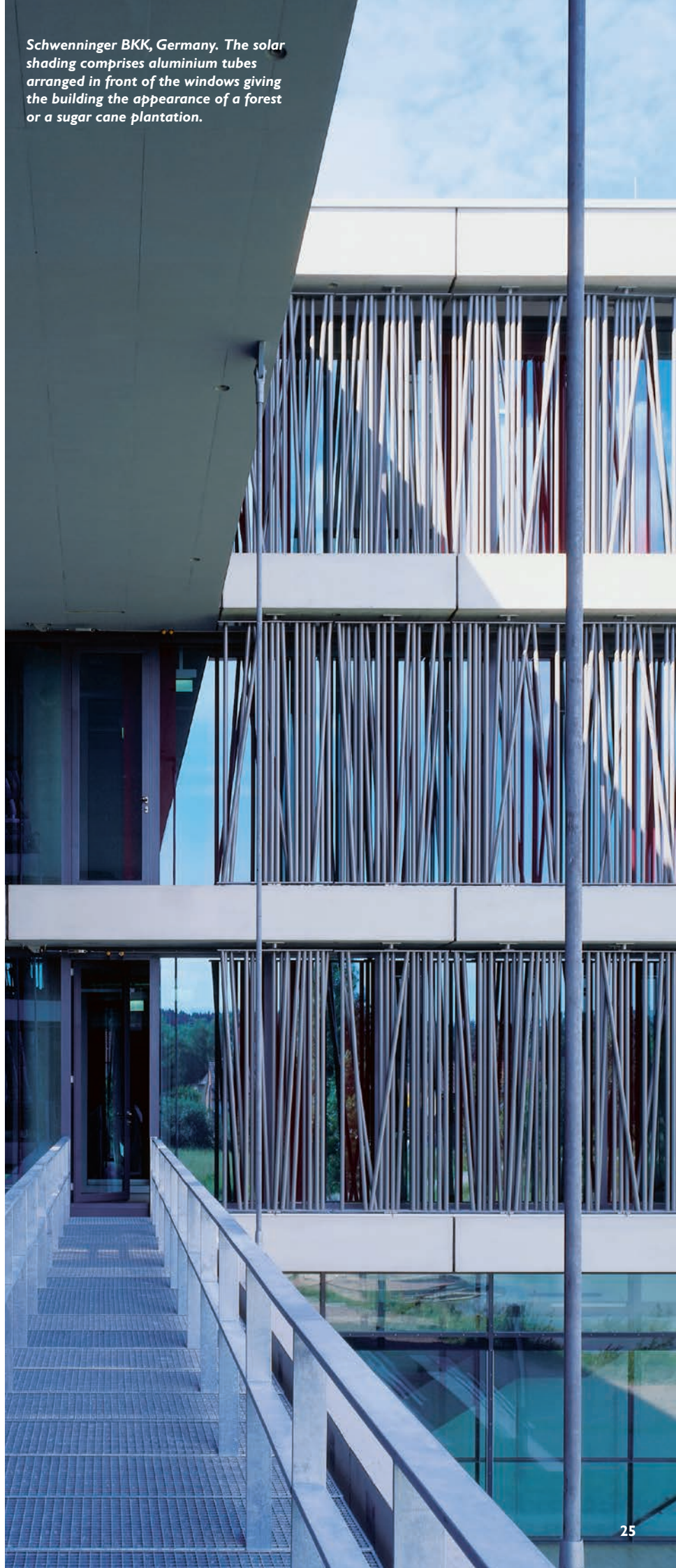
Baader Securities Bank, Munich, Germany. The building has been nearly entirely wrapped in louvers made of PTFE glass fibre Shadotex textile louvers. Louvres are individually adjustable and have greatly reduced the energy use of the building.



iHomeLab, Switzerland. The louvers give an appearance of a fish moving. The louvers themselves consist of a total of 380 fixed and 300 moveable louvers installed vertically on a building which has an exceptionally high thermal performance.



Schwenninger BKK, Germany. The solar shading comprises aluminium tubes arranged in front of the windows giving the building the appearance of a forest or a sugar cane plantation.



Product Overview

SHADOGLASS

Glass louvres such as Shadoglass allow plenty of daylight to come through whilst reflecting and absorbing the sun's rays. Variations of glass control the precise amount of daylight and solar radiation entering the building.



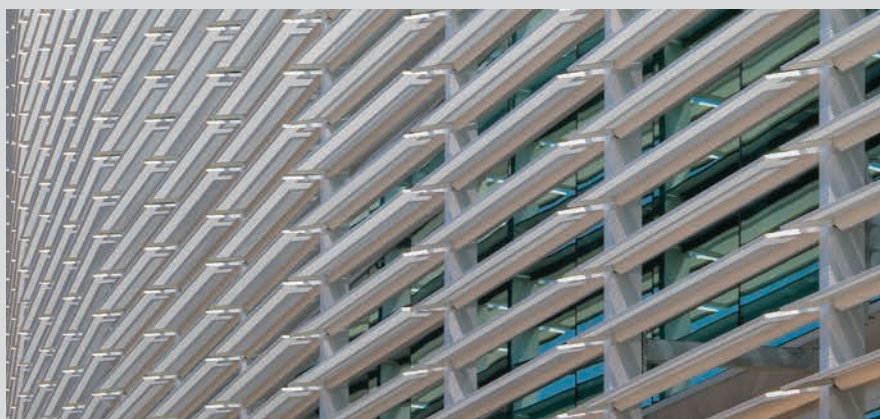
PRISMALITE

Acrylic prism louvres such as Primalite reflect direct sunlight but allow diffused light through, thereby reducing solar heat gains but allowing in plenty of natural daylight.



SHADOMETAL

Fabricated louvres such as Shadometal are often perforated to control the precise amount of daylight and solar radiation entering the building.



SOLARFIN

Solid extruded elliptical louvres such as Solarfin provide efficient daylight control as well as solar protection.



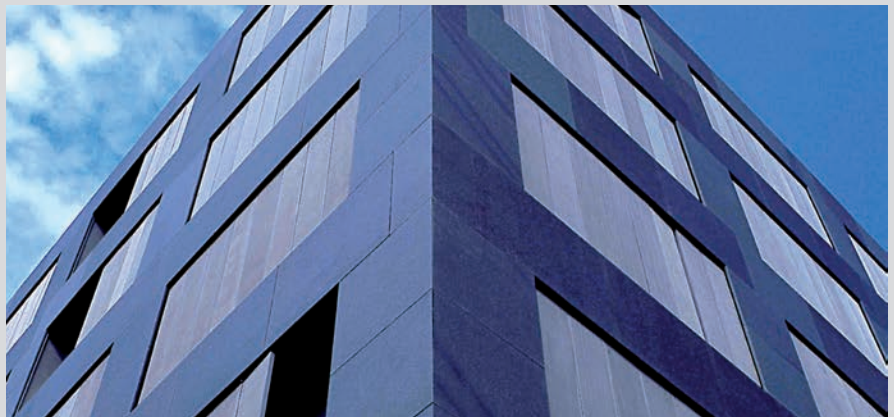
SOLAR C

Brise soleil systems such as Solar C are installed above and around windows.



ELLISSE

Sliding shading systems such as Colt Ellisse provide a versatile means of providing shading, using panels which slide or rotate either vertically or horizontally.



SHADOVOLTAIC

Sun tracking glass louvres can have integrated solar cells fitted to them enabling electricity to be generated. There are many different cell types enabling a wide range of visual effects.



SPECIAL SOLUTIONS

Many other designs are possible than are shown here, for instance with louvres made from fabric or wood.



Why choose Colt solar shading and daylight control systems?

When we sit inside a building, we all recognize the benefits of natural daylight entering through the window. We respond better when we can have a view to the outside and work better under controlled natural daylight conditions. And we all naturally like buildings that evoke interest and admiration, an effect many architects achieve using large expanses of glazing. This also fits in with the drive towards reducing energy consumption, as it enables building designers to maximize the use of natural light. The challenge then is to do that without the problems of glare or excessive solar heat gain.

That's where **Colt's expertise** comes in: you need a well-designed and well-chosen solar shading system to achieve the necessary functional performance and to meet the aesthetic requirements of the building. Colt can provide a complete package of scheme design, manufacture, installation, commissioning and maintenance.

When you work with Colt, you can **count on full peace of mind** in every phase of the project and for the full life cycle of your system because our experts understand the engineering and architectural challenges of different buildings. We:

- Look at the complete picture: we know how a building works and have extensive in-house expertise in a broad range of technologies.
- We work with the architect, providing calculations to ensure that our solution delivers the best performance with the potential for a strong architectural statement.
- Customise our products to fit the exact requirements of your project and, where necessary, have them specially tested at our R&D facility.
- Supply our high quality products, manufactured under quality standards and third party tested to rigorous standards.
- Install and commission your system: our experienced, professional project management teams will take care of everything.

Every type of building presents different dynamics and requirements. Our experts are able to design custom solutions that take all variables into account to create a comfortable and healthy environment, and over the years we have built an enviable track record.



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"People feel better in Colt conditions."

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