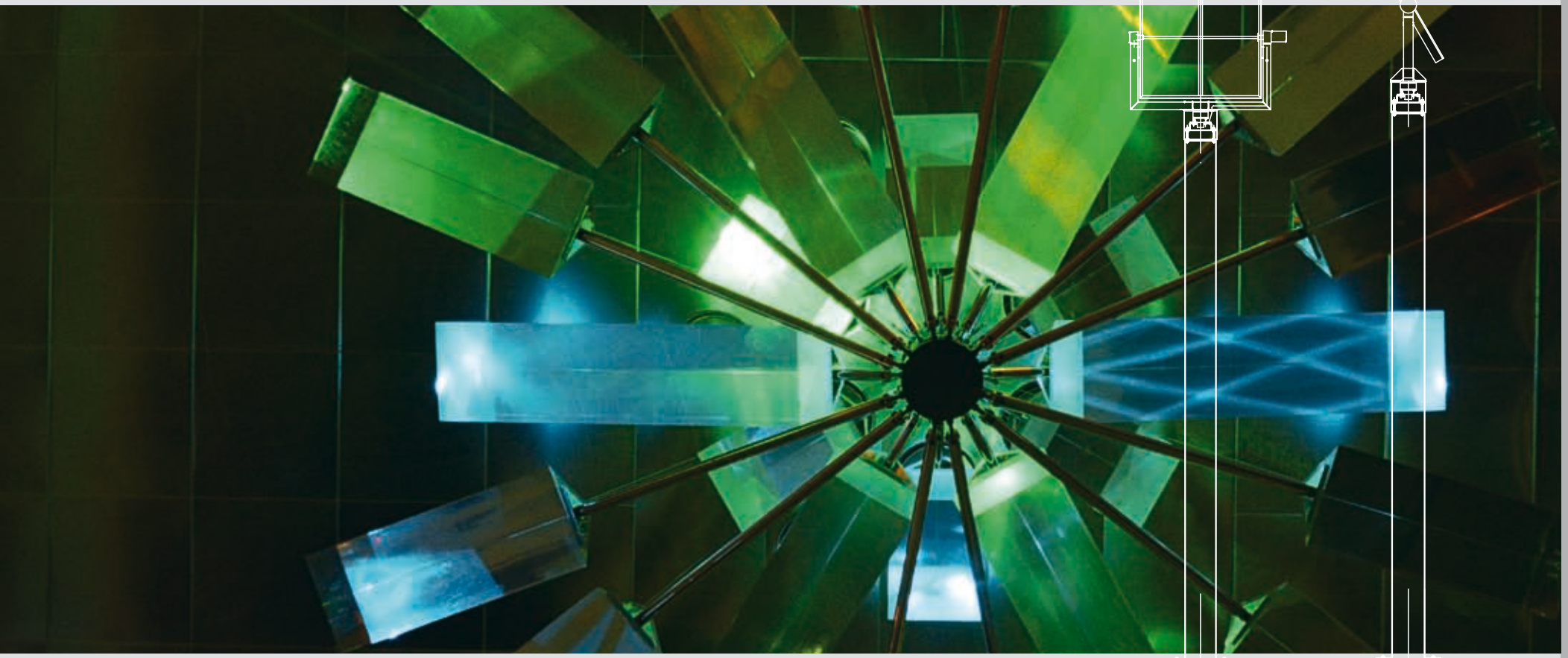
Lightron

Heliostat system bringing natural light into buildings by the reflection of sunlight



Colt Heliostat Natural Daylighting System

LET THERE BE LIGHT

Light enables us to see and observe. Amongst all the senses, our eyes provide our first impressions.

Light is a very special type of energy. You can see it but you can't feel it. You can't weigh it or cut it down into manageable pieces, so it is not surprising that people have always been busy in uncovering and working with the secrets of light and light radiation.

When we do not have enough natural daylight we use artificial light. It expands our internal living space. Light is a fundamental necessity of life, but light is more than just a means of combating darkness: not only does it give character and colour to the internal space, but also it has an influence over how we feel.

Natural daylight is the most important source of light for us humans and is essential for daily life. The human organism needs natural daylight for the formation of vital hormones and vitamins, and our metabolic processes are influenced by it.

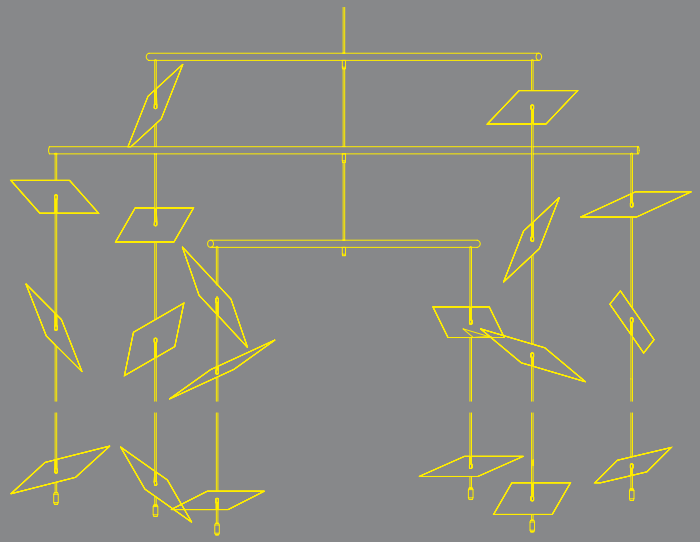
As natural daylight is so important for providing a feeling of wellbeing, it ensures that adults can work more effectively and children can learn more quickly.

Light as a visual experience. Incident light is broken down into its component colour spectrum providing a dazzling display of lighting effects.

“Light is both energy and information – content, form and structure. It has the potential for everything.”

David Joseph Bohm, Physicist

Effective lighting bathes the building’s interior in a special atmosphere and reflects the mood of a room.



Light reflection elements such as mobile chandeliers distribute the reflected natural daylight into the building interior, and make the internal space come to life.

DESIGNS WHICH ENHANCE NATURAL DAYLIGHT

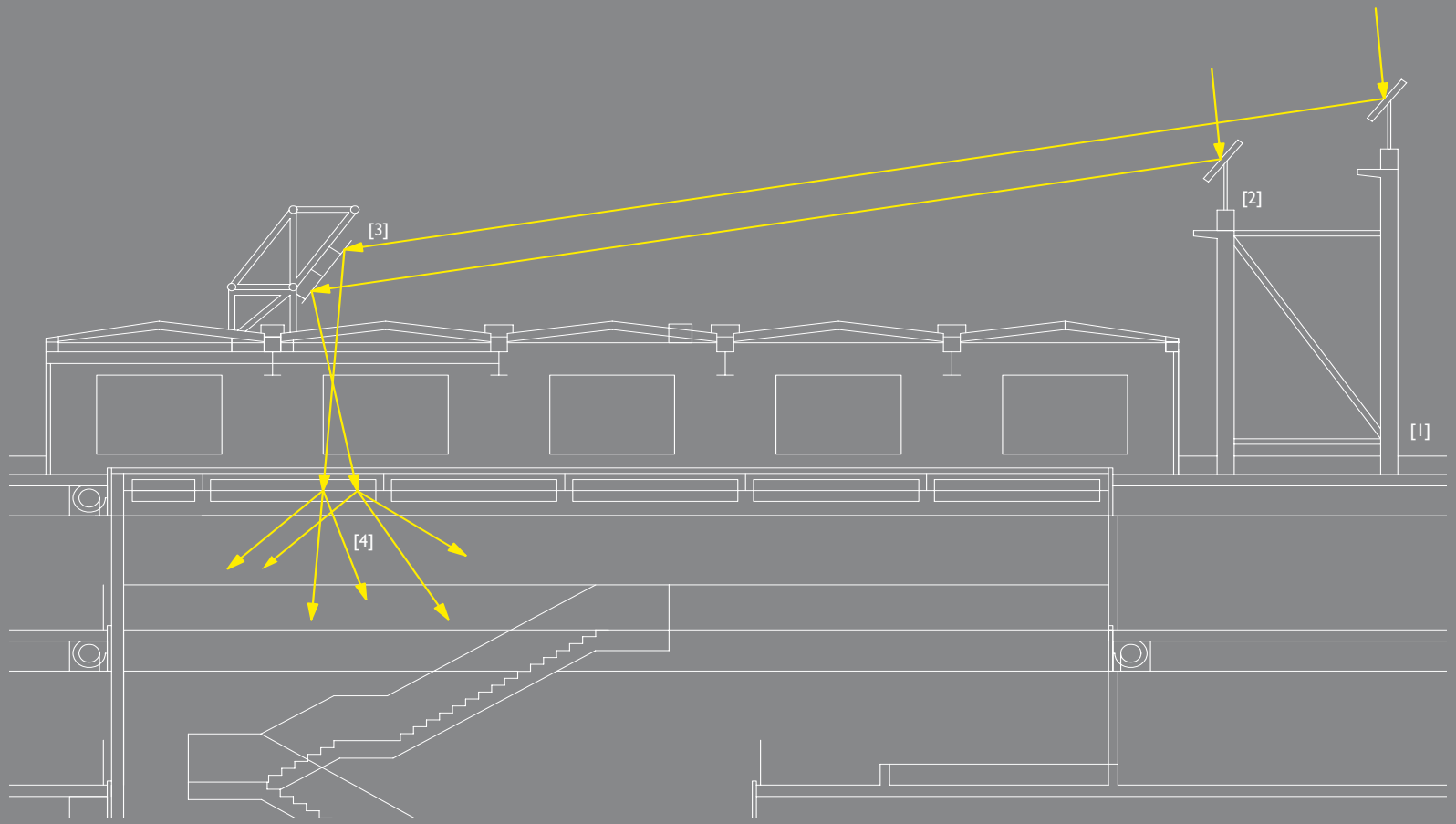
One reason why there are so many ways to engineer elaborate lighting design schemes is that each building has its own character. Lighting design is one of the main elements of modern architecture, and rightly receives particular attention where buildings either are tall or narrow, when it is challenging to design an economic lighting system. The reflection of daylight into such spaces can achieved by heliostats, amongst other systems. Heliostats bring the daylight directly to where it needs to go and this can be achieved over great distances. If a heliostat is properly designed it can even bring daylight into underground areas of a building.

Heliostats are reflectors which move in two planes and track the sun, thereby reflecting the light according to its position in the sky. Very often one additional fixed mirror re-reflects the light that has been reflected on the heliostat. The mirrors are generally installed on the outside of the building. For this reason they need to be provided with a very thin glazed finish which both protects them against the adverse effects of weather and ensures that there are minimal transmission losses as it is reflected into the building.

Indeed, such heliostats ensure that, compared to fibre optic systems, there are very low transmission losses and thus the light can be directed over very long distances. In addition the spectral quality of natural daylight which is reflected into the building provides good quality internal lighting. Although it is necessary to possess a good deal of knowhow and experience to satisfactorily design and install a heliostat system in any type of building, at least such a device makes sure that a piece of heaven illuminates even the darkest internal spaces.

Image on the right:
Genzyme Headquarters, Boston, Cambridge, U.S.A.
Architect: Behnisch, Behnisch & Partner, Stuttgart & Los Angeles
Colt Lightron Heliostats provide a playful display of light within the building interior and gives the atrium a light, airy feel.

Drawing. How a heliostat system works. Most heliostats are fixed on to the roof (1) so as to bring light into deep internal spaces. A receiving mirror (2) which moves in two planes brings the light towards one or more additional mirrors (3) and this light then eventually is passed either through a window or a glazed roofing element into the building. Once the light is in the building the light is distributed through other chandelier systems or prism louvers (4) so as to provide special effects.



On the Genzyme building seven sun-tracking bi-axial Lightron heliostats were used. These direct the light to seven fixed mirrors on the roof enabling daylight to be permanently channelled into the atrium building.

Foto © Roland Halbe

THE INTERNAL DISTRIBUTION OF LIGHT

Heliostat systems bring natural daylight into buildings in two stages. The ever-changing position of the sun is tracked by the heliostat and its light is channelled either directly or via a stationary reflecting mirror on to a pre-determined area within the building. At that moment the work of the heliostat is done. The size of the mirror and the area of projection determine the brightness of the spot of light.

The second stage is the distribution of the light within the building. Many different types of materials can be used to distribute the light.

Natural daylight distribution systems very often consist of one or more devices:

- Concave or convex reflecting mirrors either to concentrate the light or to diffuse it.
- Light diffusing elements which remove the glare from the light and bring it to the working area.
- Prismatic panels or louvers to provide a spectral effect.
- Coloured foils which either are laminated into glazed panels or are freely hanging mobiles.
- Or a combination of any of the above mentioned devices.

The photos show how these different types of distribution system can provide different shapes, colours, contrasts and dynamism within the internal space. The architect will be considering the colour, shape and surface textures of internal elements to be able to integrate the light-show in a special way.

The complexity of this task requires a high degree of experience and specialist knowhow. It is essential for lighting designers to be involved at an early stage of the building's design.

Illustrations top right and below.
BMW, Munich II Airport, Germany.
Architect: Arne Bohlken, Munich.
The heliostats create an incomparable array of light in the exhibition hall.

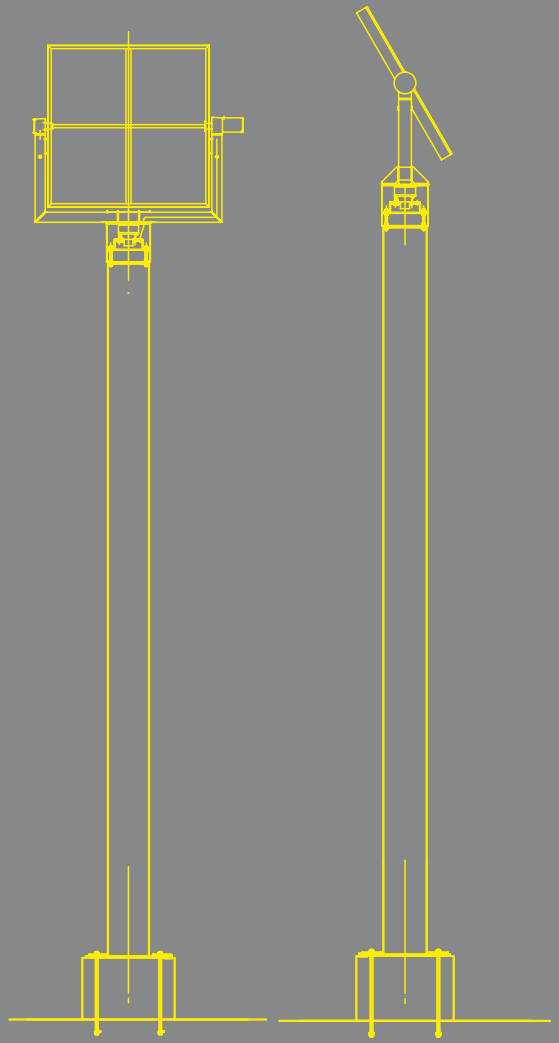


Image right:
Paragon, Seoul, Korea.
Lighting design: Lee & Reis Co, Seoul.
Heliostat systems are installed on a 14-storey high luxury apartment building and allow natural daylight to fall on a façade which otherwise would be in shade.

THE ADDITIONAL BENEFIT OF ENERGY SAVINGS

If as much natural daylight as possible is brought into a building, this has a very positive affect on the energy balance since the needs for artificial light reduce.

To illustrate, the energy consumption for a traditional light bulb is 95% heat and only 5% light. The production of this heat in turn increases the cooling loads where air conditioning systems have to be used.

However, heliostat systems are rarely installed so as to reduce energy use. They are mostly used to improve the feeling of wellbeing and/or aesthetic effects but the positive impact on energy use should not be underestimated.


[1]


[2]


[3]

[1] The Swiss National Library, Bern.
Architect: A Furrer and Partner AG, Bern.
Even though the archive of the Library is around 20m deep underground, natural daylight can reach right into the underground space.

[2] Sikna Retirement Home, Zurich.
Light Planner: Bartenbach Light Laboratory, Innsbruck.
The colour and light effects provide a unique atmosphere on each floor.

[3] Rhein-Sieg Technical School, Rheinbach, Germany
Design: Vogt & Partner, Düsseldorf
A series of freely hanging mirrors provide coloured effects on to the ceiling of the building and the internal walls.

[4] Civic Centre, Canton, Zug, Switzerland
Architect: Web, Kohler, Reinhardt, Zug
Heliostats are connected with banks of reflecting mirrors to brighten up the reception area and staircases providing a very special internal lighting effect through the use of prisms.

[5]Österreichisches Siedlungswerk, Vienna
Architect: Neumann & Steiner, Vienna
Heliostats reflect light into narrow staircases.

[6] National Museum Korea, Seoul.
Architect: JUNGLIM, Seoul
Natural daylight is targeted towards the illumination of artefacts by the creation of natural and intensive light spots for special effect.


[4]


[5]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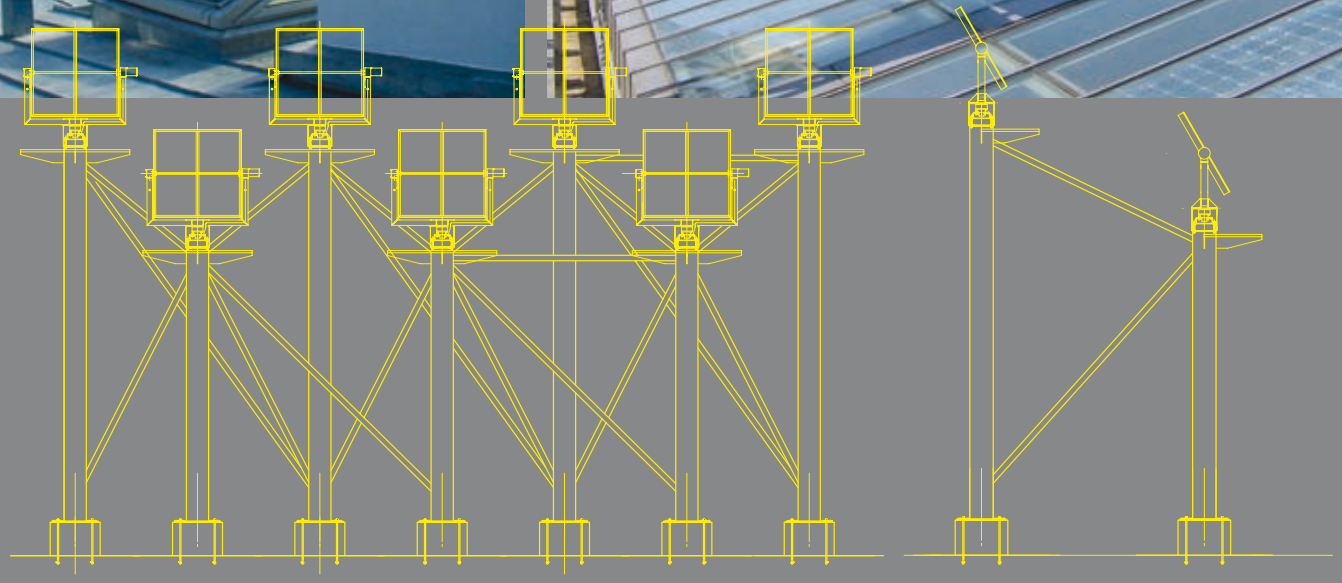

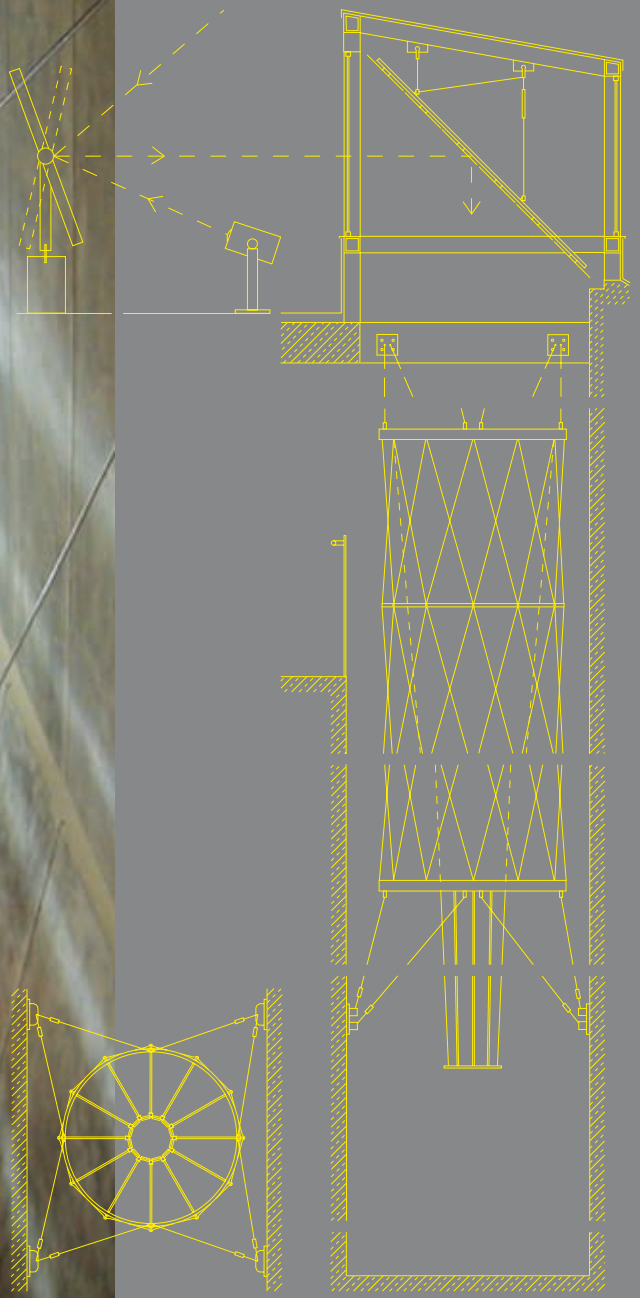

SPECIAL PROJECTS

Special requirements need special solutions.
The design possibilities are almost unlimited.

Drawing and image on the left:
Morgan Lewis Offices, Washington DC, U.S.A.
Architect: Carpenter & Norris Consulting, New York.
A multiple mirror system directs the sunlight into a specially designed light tube. This allows the light to spread downwards and horizontally into the deep internal space.

Image on the right:
"Light Threshold" for the 2000 Olympics in Sydney.
Architect: James Carpenter Design Associates Inc, New York.
Here five high masts each generate a fine mist. Depending on the time of day either sunlight or artificial light is reflected onto these elements from a nearby heliostat to provide a spectacular illuminated cloud effect.

Colt Heliostat Natural Daylighting System

- Colt offers comprehensive service fulfilment of heliostat projects. This can comprise initial concepts, detailed design and structural calculations, and the manufacture, supply, installation and commissioning of heliostats and their associated controls throughout the world. Colt can also offer maintenance.
- Colt takes care of the environment and provides products and solutions for low-energy buildings. Many different applications of Colt products and systems have been carried out on buildings which have achieved Gold & Platinum LEED ratings.
- Colt heliostats bend light into buildings and thereby create a more comfortable internal experience, generate exciting internal lighting scenarios and also make a statement for the users of the building about the client's attitude to innovation.
- Colt heliostats have been installed in banks and insurance offices, shopping malls and commercial premises, hotels and hospitals, leisure and administrative buildings, airports and public buildings.
- "People Feel Better in Colt Conditions".

For further information please visit www.bomin-solar.com or www.coltgroup.com