The green blue building

Deutsche Bank makes its mark as a pioneer in environmental design.

Text: Prof. Susanne Brenninkmeijer, PLDA

Klaus Adolph and Wilfried Kramb, ag Licht.

One of the most modern buildings in the Federal Republic of Germany is located slap bang in the centre of Frankfurt-on-Main on a 100,000 square metre plot of land: a pioneer in the field of green architecture in Europe. Together with a team of renowned architects and specialist planners the client, the Deutsche Bank Frankfurt, is planning a complete refurbishment of the twin towers, and the result will be designed to meet the most stringent sustainability requirements. The stipulations laid down by the US Green Building Council in LEED, the Leadership in Energy and Environmental Design, form the basis for the bank's refurbishment programme. In fact, the Deutsche Bank aims to achieve the highest form of LEED certification for their modernization project: platinum level. In the United States LEED guidelines are already regarded as a source of reference for health-promoting, environment friendly building. In Europe, the United Kingdom and France already issue Green Seal Certification for buildings, and in the United Arab Emirates and Japan similar models are also in application.

Germany is currently also fighting to introduce a certification system. The Federal Department of Transport, Building and Housing is battling it out with the German Society for Sustainable Building, which comprises 80 architects, engineers, scientists, construction companies and investors. It looks like an agreement in is sight because the two parties have already taken a vote on the certification criteria. So Germany will presumably also soon be in a position to issue ecological seals for buildings. This development is as much good news for the environment as it is for the users of the certified buildings: points are given for the application of healthy materials, good ambient air, barrier-free design and optimized technical and cost-effective design – all in line with LEED stipulations.

Guildelines of this kind present the designers of a building with a new challenge. In the case at hand, the design team lined up to refurbish the twin towers were ready to face the challenges they knew they would encounter. The team comprises the renowned Milan-based architects' office of Mario Bellini, who recently laid the foundation for the Islamic wing in the Louvre, project architects Gerkan Marg and Partners, and the lighting design practice ag Licht from Bonn. The task was to maintain high-quality design throughout the project and at the same time to collect LEED points according to the Green Building Rating System.

The Deutsche Bank project in Frankfurt even managed to collect points for the deconstruction and demolition work. The goal of the Bank was to achieve a 98 per cent recycling rate and to actually re-use some of the components.

The requirements for daylight design are that the interior spaces receive sufficient daylight and that users have a clear view outside. In principle, these LEED points are in line with the requirements laid down in the existing daylight guidelines for the workplace. In the design phase it is possible to check if the requirements are met by means of calculations: the glazing factor should reach a minimum of two per cent in 75 per cent of all used space. This can be proven using simulation software, whereby a minimum horizontal illuminance of 250 lux must can be achieved on 75 per cent of the used area. The value is calculated under equinox conditions under a cloudy sky. This can be verified under the same conditions under which the simulation is calculated by direct measurements undertaken in the building.

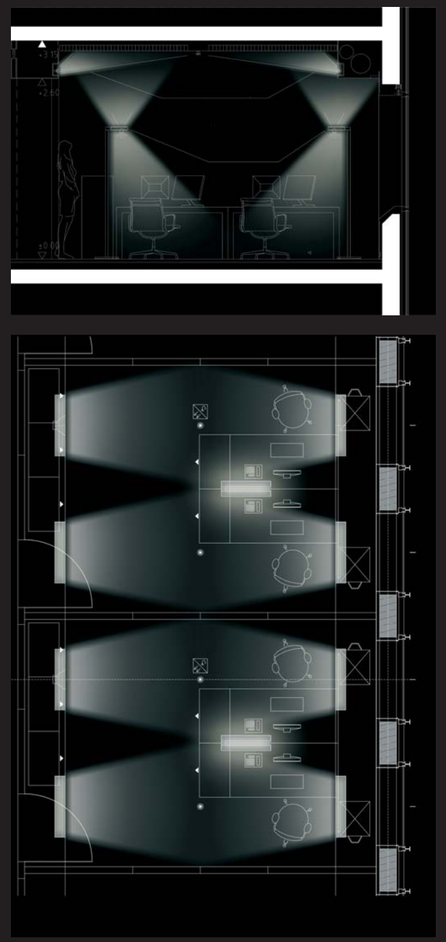
Meeting these LEED requirements for daylight is one of the challenges facing the design team working on the Deutsche Bank building, because the existing facade is basically a perforated facade with a suspended glass facade added that has a relatively low transmittance of 40 per cent. Points can be gained for the view outside, however, especially since the large, open-plan office spaces afford views from workstations located further away from the windows. Good daylight conditions coupled with daylight-controlled electric lighting make for a substantial contribution towards energy saving.

The lighting designers also had to fulfil a number of requirements related to the electric lighting. Starting with ambitious connected loads of 11watts per square metre for the entire building, which meant all interior spaces including foyers and lobbies, restaurant and cafeteria, bank branch office, event areas, board rooms and conference rooms plus the video conference area. This value is a basic prerequisite for participation in the LEED certification programme. This connected load can only be realized through the development of new office lighting concepts and through the application of user-dependent lighting control in the majority of areas, especially in the offices that make for the bulk of the used space, but the appropriate use and type of lighting control also needs to be rethought for the other areas. The team of lighting designers from ag Licht are currently performing a masterful balancing act with their concept, which aims to combine what they are obliged to deliver with the kind of designed lighting they prefer. The goal is to use a lighting control system as described above that will answer to practical, functional requirements, but will also allow the pre-programming of different designed lighting atmospheres. This clever combination of economic efficiency and the art of integrating different lighting effects to create aesthetically pleasing ambiences is to be applied throughout the entire project. Prof. Holger Hagge, Director of Strategic Projects and Project Leader for the refurbishment of the Deutsche Bank's twin towers: "In the new offices our staff will be able to select from different lighting scenarios. We will also use daylight more efficiently, which will cut energy consumption by half and at the same time improve the working environment".

The concept consists of positioning 'light sword' luminaires in the office spaces parallel to the facades as well as in the depth of the space along a ceiling coffer to provide uniform ambient lighting for the overall area.

The 'light sword' was required to provide a high degree of visual comfort in the office space. The diffuser is made of prismatic acrylic glass to eliminate glare in all directions and to direct the light downwards onto the workplace. This lighting compo-

The office towers of the Deutsche Bank in Frankfurt-on-Main/D.



Section and plan view of the office showing the effect of the lighting using cove lighting and a direct/indirect free-standing luminaire.

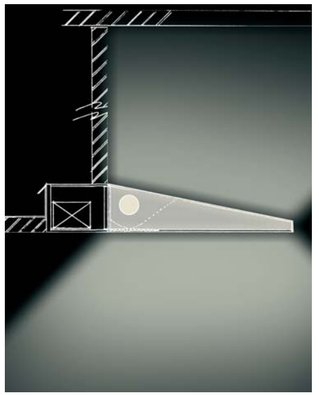
Section and plan view of the office showing the effect of the lighting using 'light swords' and task lights.

nent makes for an even spread of ambient light of around 300 lux. Task lights on the desks can be switched on to achieve the recommended 500 lux for office workplaces. Office staff are generally happy with this solution, since it gives them the choice of determining how bright they want their individual task area to be. Combining the light from the different light sources in this way also makes for a pleasant atmosphere because the light is not flat or monotonous. Since the basic light source is controlled centrally, and the supplementary light source individually, less energy is required to meet the stipulated guidelines.

An alternative solution might be to apply luminaires equipped with involute reflectors parallel to the facade so that they can contribute towards illuminating the ceiling deeper inside the space and support the ambient lighting. These could be used in combination with direct/indirect free-standing luminaires positioned close to the workplace. Thanks to the lighting provided by the luminaires with the involute reflectors, the free-standing luminaires could be equipped with relatively low wattages, but should primarily be used for the direct lighting of the workplace.

In open-plan spaces and offices accommodating two or more persons the office lighting also includes multi-functional zones such as open circulation spaces and areas dedicated to archiving. These zones will receive a series of recessed downlights mounted directly above a highly translucent ceiling mesh to provide a gently illuminated ceiling surface. A continuous row of recessed luminaires with glass diffusers will run around the service core along the walls, accentuating the latter and structuring the space as well as providing a means of orientation. Lighting control in the form of presence detectors or daylight-related control is to be installed in all the above-mentioned spaces. The exact type of lighting control is yet to be defined. To fulfil the desired requirements user-dependent lighting control must be installed for 90 per cent of the users. This applies to individuals or to groups of employees in one room.

Mock-up of 'light sword'.



Section showing the principle of the 'light sword'.

The nighttime image of the 38-storey building in its prominent location in downtown Frankfurt is defined by the office spaces in the two towers. The luminaires mounted on the ceiling trough along the facade wash soft light over the ceiling surface closest to the windows and thus support how the building is perceived from the outside. Additional lighting on the outer surface of the façade is not necessary. This also means that the building fulfils LEED requirements to reduce light pollution caused by light directed outwards from the structure. The lighting of the grounds around the building is to be adjusted in due course.

This refurbishment project is a huge challenge to all concerned in the design and implementation of the concept. The benchmarks are set extremely high. That having been said, it is of enormous importance to create a case of precedence, which can only stand in good stead for the current developments in the green building sector. Besides cutting energy consumption by half, it is the users who primarily gain from their substantially more attractive working environment. This in turn means enhanced motivation and productivity. All in all, in the interest of the people who work in the Deutsche Bank headquarters in Germany. Calculated to be a success, you might say, and who calculates better than a bank? One can only hope that further refurbishment programmes for existing buildings, as well as new buildings, will follow the example set by Deutsche Bank.

Perspective rendering of the 'light sword'.