

Revitalising office towers




The headquarters of the Kreditanstalt für Wiederaufbau (KfW) was built in the late 1960s as a group of office towers in Frankfurt's Westend. In recent times, the building was starting to look somewhat down at heel and therefore the owner decided that it needed to undergo radical modernisation – only the load-bearing framework from the original building remained intact. This enabled the provision of daylight, fresh air, heat and cooling to be considerably improved and, above all, to be carried out in a much more energy-efficient way. Facade, interior fittings and technical services for the approximately 22,000 m² building complex were renewed between 2002 and 2006. This made it possible to create a modern building that externally looks rather low-key but is very energy-efficient. The fire protection and workplace conditions are now state-of-the-art, too. Furthermore, with this ambitious refurbishment the KfW Bankengruppe has underlined its intention to promote environmental and climate protection.



Detail of the new facade with movable parapet elements made of glass and metal mesh, which provide sun protection that can be controlled room-wise.

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Building summary

Project status	 In Operation
Location	Palmengartenstraße 5-9, 60325 Frankfurt am Main, Hessen
Year of construction	1968
Refurbished	2006/2007
Building owner	KfW Bankengruppe (+ Betreiber und Nutzer)
Gross floor area	26,000 m ²
Heated net floor area	21,432 m ²
Gross volume	98,656 m ³
Work places	585
Usable floor area (according to EnEV)	10,910 m ²
A/V ratio after refurbishment	0.19 m ² /m ³
Key aspects	Facade systems, Daylight planning, Daylight systems, Optimised lighting, Ventilation + heat recovery, Combined heat and power generation, combined heating and cooling, Control technology, operational management, building automation, Optimisation of operations

Project description

The KfW's four office towers were constructed between 1964 and 1968. They are staggered relatively to one another by the depth of a cellular office space and rise by different heights. With a maximum height of 62 metres, these have never been remarkably high buildings by Frankfurt standards. The office towers had narrow balconies in whose shadow top-hung windows were arranged in strips.

Just in terms of the fire protection regulations there was need for improvement. The appearance of the towers had also long ceased to match the image which the owner and occupants wished to convey. Therefore it was decided to opt for a radical modernisation.

There were only very limited possibilities for extending the building complex at the location. On the north side there is a population of mature trees, on the south side there is an arcade building from the 1980s which is also used by the bank. This left just the west side, where the German Library (Deutsche Bibliothek) had stood until

recently. Here it was possible to place an event and exhibition hall before the two southern-most towers. The third tower in the row was extended with a two-storey conference room. The northern tower was heightened by three full stories and now houses the executive board rooms. The ground floor was also extended and now boasts a representative entrance area that looks onto the courtyard. The newly designed office areas contain both small individual offices in cellular form as well as team offices for groups of up to 6-10 staff members. The building was reoccupied in August 2006 and measurement data have been recorded and evaluated since February 2007.

Refurbishment concept

The KfW Bankengruppe now places considerable importance on user comfort with low energy consumption for all its buildings. For instance, the new facade controls the light, air and heat supply, and, together with new building services equipment, ensures primary energy savings of almost 50 per cent. The refurbishment was thus intended to be an explicit modernisation and to impart the office towers with more than just a new appearance.

However, the fire protection requirements had to be first of all met: escape routes had to be coherently designed and fire and smoke compartments separated off. In addition, early fire detection measures also had to be provided and access possibilities for the fire brigade created. The old facade, including the balconies, was completely removed; only the load-bearing structural framework remained.

Energy concept

The energy-based modernisation of the office towers is based on the following factors:

Considerably improved thermal insulation: Facade: U-value from 1.1 to 0.28; windows: U-value from 2.9 to 1.4; roof: U-value from 0.79 to 0.21.

Ventilation concept with air exhaust system, customized control concept and passive cooling using overnight ventilation to reduce the cooling energy requirement. Because of the low ceiling heights and the numerous downstand beams, an energy-efficient supply and air exhaust system would have been problematic on the office floors. Therefore this was limited to a pure air exhaust system in the office areas. The standard offices are supplied with the necessary fresh air via a central air exhaust system and air vent openings above the windows. The air in the offices is drawn through shadow gaps into the intermediate space above the suspended ceiling and from there is drawn via a channel into a collection duct, which leads up the stairwell to where the air is then dissipated via a central exhaust ventilator. The air renewal is controlled in accordance with the outdoor temperature in order to reduce energy losses with cold outdoor temperatures and to avoid additional heat influx when there are very warm outdoor temperatures, which might lead to overheating. The air vent openings are controlled in accordance with the outdoor temperature and whether people are present. As for various reasons it was not possible to dispense with ceiling claddings, suspended cooling ceilings now ensure improved room temperatures.

Cooling provided by means of co-generation: Since the mid-90s, there is a CHP plant for heat provision of the KfW buildings. The waste heat from this plant is now used by the absorption cooling systems for generating cold air. For very hot days there are now additional compression cooling machines for air-conditioning the buildings. Decisive for the primary energy balance will be the contribution made by the absorption cooling systems, which obtain their operating power from the waste heat generated by the combined heat and power system.

Facade concept with a new kind of sun protection and aerodynamically optimised supply air element: The sun protection elements can be moved vertically up and down and can be tilted as well. The sun protection can be controlled centrally and individually for each room. The elements, which consist of metal mesh sandwiched between glass panels, allow daylight to penetrate while providing a dim degree of visibility outwards.

Optimised daylight utilisation with presence and daylight-dependent lighting control. Depending on the amount of daylight available, which is measured by a light sensor above the table surface, the lights provide additional artificial light in order to attain a light level previously set by the user. Here the target light level does not remain constant but increases slightly as the external lighting strength increases. This measure takes into account that a room with a constant level of lighting is considered to be darker when daylight from outside increases. If the occupant forgets to switch off the light in his office, the building control technology will do that automatically 15 minutes after he has left the room.

Water-saving sanitary concept using grey water, vacuum technology and rainwater.

Performance

The energy balance for 2007 is currently being produced. Delays occur, since there are currently differences in the monitoring between the main and sub-meters which need to be first of all clarified.

The planned modernisation and consolidation of the cooling and heat generators to form an effective combination for the entire KfW complex is still in progress. Since currently not all the absorption cooling

systems are running and the CHP plant is not yet operated at full capacity, the planning objectives for the primary energy balance have yet to be attained.

Optimisation measures and possibilities

Information on this subject will become available as the project continues.

Construction cost and profitability

Information on this subject will become available as the project continues.

Key energy data

Energy indices according to German regulation EnEV (in kWh/m ² a)	before refurbishment	after refurbishment
Heating energy demand	113.20	74.00
Overall primary energy requirement calculated with DIN 18599 - according to: heated net floor area	215.10	94.40

 [website with monitoring-data \(german\)](#)

 [architectural presentation \(german\)](#)

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