New building for the German Federal Environment Agency in Dessau

EnBau


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The German Federal Environment Agency's new building in Dessau is certainly an eye-catcher. The building was designed as a colourful, gently curving 'strip' made from wood, metal and glass, and it defines the whole site. The building designed by the Sauerbruch Hutton architecture agency is also quite ambitious in terms of energy efficiency and ecological aspects. The long atrium in this new building is a protected room with greenery and also serves as a thermal buffer. As an EnOB model project, the building was subject to intensive scientific monitoring. The results are now available. In 1992, the German Federalism Commission decided to move the Federal Environment Agency from Berlin to Dessau, and 13 years later the move to Dessau was finally complete. More than 750 employees now work in the new office building. Some parts of the Agency will remain in Berlin – including the laboratories and the German Emissions Trading Authority. In addition, there are branch offices of the Agency in Langen in the state of Hesse and in Bad Elster, Saxony.

Building summary

Project status	Optimized
Location	Am Wörlitzer Platz 1, 06844 Dessau-Roßlau, Sachsen-Anhalt
Completion	2005
Inauguration	2005
Building owner	Umweltbundesamt (+ Nutzer/Investor)
Gross floor area	35,765 m^2
Heated net floor area	32,384 m^2
Gross volume	184,855 m^3
Work places	790
A/V ratio	0.34 m^2/m^3
Key aspects	Heat insulation, Facade systems, Atrium, Daylight planning, Daylight systems, Optimised lighting, Ventilation + heat recovery, Active cooling, Regenerative + passive cooling, Combined heat and power generation, combined heating and cooling, Solar thermal energy, Photovoltaics, Ecology of building materials, Optimisation of operations

Project description

The decision in favour of Dessau as the location of the new offices for the Agency was taken in 1992, and was based on a recommendation by the German Federalism Commission. A competition was held in 1997, which sought a design for a showcase ecological building with high standards as regards energy efficiency and the use of renewable energy sources. The building was opened on 11 May 2005.

The new offices are centrally located in the town, and are also close to the old "Gasviertel" industrial area. The ground was strongly contaminated, and most of the ground soil thus had to be treated and replaced. The construction of a very large earth-to-air heat exchanger was carried out as part of these extensive works.

The main building consists of a four-storey office wing with atrium and forum, and is designed in such a way that a 'snake-shaped' building results. The forum is the central area with the entrance and all public facilities. The new and existing library buildings border on the office section. Other parts of the complex include the canteen and the 'Wörlitzer Bahnhof' railway station. The total building volume is around 200,000 m^3.

The planning process was characterised by comprehensive conceptual analyses and simulations with the aim of achieving the ecological goals. An ecological specification document was the basis for this. Expert committees advised the client and the planners regarding efficient energy use, the ecological use of building materials, soil protection, indoor air hygiene and many other topics.

The building has enough space for 790 employees. The room layout consists of small single offices each with the same design, which are combined with larger common and service areas.

Building concept

The main building consists of a reinforced concrete skeleton construction with ceiling slabs and a support grid of 5.50 m. The ceilings remain uncovered. Ducts for electricity, data and other cables are integrated into the floor channels. The atrium and forum are fitted with a glazed north-south-facing sawtooth roof. A photovoltaic system is integrated into the forum roof, and both glass roofs have textile sun protection fitted on the inside. The main building's external facade is designed as a multi-element facade with a wooden-panel construction. Horizontal strips of wood cover the parapet and lintel areas. The window strip is divided into transparent and colour areas. This zone has windows that can be opened, opaque pivot-opening elements for night ventilation, and glass-covered wall elements.

The windows (U value 1.2 W/m²K) have another single layer of glazing on the outside, with the sun protection fitted behind this. 35% of the exterior facade is glazed. The interior facades facing onto the atrium and forum also consist of wooden elements. The windows facing onto the atrium (U value 1.3 W/m²K) have glare protection fitted on the inside. The main building has four storeys, while all other buildings have between one and three storeys. Basement space is provided underneath all of the main office building: 15% of the basement is heated. The roofs of the main building and the canteen are flat and partially planted with vegetation.

Energy concept

The energy concept has managed to better the German Heat Insulation Ordinance of 1995 which was binding at the time by more than 50%, to limit the total electrical energy requirement to a maximum of 40 kWh/m² p.a. (based on the net floor area), and to meet at least 15% of the overall energy requirement from renewable energy sources.

The building is mainly heated using district heating. When the outdoor temperature is particularly high or low, the supply air to the offices is conditioned in an earth-to-air heat exchanger. The total length of the pipe array is around 5,000 m. The air intake and exhaust systems for the office area include heat recovery equipment with a recovery efficiency of 74%. Solar-assisted cooling is used for the IT rooms and the lecture theatre. The desired cooling effect is achieved here in an adsorption chiller by adsorbing the cooling agent (water) on a sorbent (silica gel). The sorbent material is primarily regenerated using solar-heated hot water which is provided by a solar thermal system with around 310 m² of gross collector area (type: heat pipe).

A solar power system is integrated into the glazing of the sawtooth roof above the forum to provide sun protection; it has a gross area of 460 m² and a capacity of 32 kWp.

Heating and ventilation

Winter

Heat is distributed throughout the offices by means of panel radiators with thermostat valves. All offices are mechanically ventilated. If the outdoor air temperature is below 5 °C, this air is fed through the earth-to-air heat exchanger for preheating before it enters the air-conditioning system. The same thing happens in summer when the outdoor temperature is above 22 °C. The supply air ducts to the offices are located above the suspended ceilings in the corridors of the building. Because of the slight overpressure present in the offices, the exhaust air passes through noise-proof flow ducts located beside the office doors and flows into the corridor. Where necessary, the flow ducts are designed in such a way that they close in an airtight manner by means of a spring return actuator in the case of fire.

At the end of the corridor, the air is extracted at a single point and exits the building via the heat recovery system. The atrium and forum are not heated or fed with supply air in winter. These areas are not part of the insulated envelope.

Transitional period

The offices in the west of the building which are exposed to noise continue to be fed with supply air mechanically, and the same can be achieved using the windows for the offices in the east. The offices are vented as in winter, with the exhaust air leaving the building via the atrium. The offices on the atrium side can be ventilated freely through the atrium.

Summer

All offices are mechanically fed with supply air that has been conditioned in the earth-to-air heat exchanger – this only occurs for the atrium offices when the outdoor temperature is above 22 °C. Venting proceeds as during the transitional period. The heat stored in the building components during the day is removed using natural night ventilation. Motor-controlled night-ventilation flaps are used in the external-facing offices for this. The air is fed into the atrium by the overflow openings in the corridors. This process is driven by the thermal lift effect in the atrium. The air-change rate can be noticeably increased by opening the office door.

Performance

The German Federal Environment Agency's office building in Dessau went into service in 2005. Since then, the building has attracted numerous visitors from both Germany and abroad because of its eye-catching

architecture and ecological design concept. Energy performance and indoor-air hygiene issues were examined as part of the scientific monitoring. Surveys among users show that acceptance of the building is high. Users of the building report “good” satisfaction levels with the comfort conditions, according to the results of a study by fbta of the Karlsruhe Institute of Technology.
Accompanying studies on the building work have shown that energy-optimised construction is far more complex than conventional building methods – from the planning phase and construction right up to the operation of the building. The commissioning of energy-optimised buildings requires at least a one-year fine-tuning phase in order to optimise the interplay of the services equipment.

Optimisation measures and possibilities

After the building was put into service, a number of areas with optimisation potential were identified – for example: the adjustment of the operating times for air-conditioning systems to account for actual requirements, and the optimisation of the heat-recovery systems including the interaction with the earth-to-air heat exchanger and optimisation of the cooling. With the aid of these and other measures, the planned target values were almost achieved in 2008 in real operation of the building. The electricity consumption corresponded exactly to the expected value, while there was a slight overshoot of a single-figure percentage value for the heat consumption.

Construction costs and economic viability

Construction costs of around 68 million euros were foreseen as part of the planning. The actual costs which arose were of this order of magnitude, but have not yet been finally calculated. Reliable information is not yet available for this.

Key energy data

Energy indices according to German regulation EnEV (in kWh/m²a)	
Heating energy demand	54.20
Overall primary energy requirement	73.10
Measured energy consumption data (in kWh/m²a)	
Site energy for heating and domestic hot water (dhw)	61.80
Source energy for heating and domestic hot water (dhw)	43.30

Implementation costs

Costs of implementation in €/m²	
Construction (KG 300)	1,211
Technical system (KG 400)	415

These figures represent established costs

Net construction costs (according to German DIN 276) relating to gross floor area (BGF, according to German DIN 277)

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