

Energy-plus primary school in Hohen Neuendorf




A model project for the research topic of “Energy-efficient schools”: This new-build school is designed to enable primary school teaching in accordance with contemporary needs. The utilisation of the latest educational teaching concepts was already considered during the planning stages. In addition, the building shall also provide considerable flexibility with a view to expected changes in the usage profile. The new school building has been designed in accordance with the energy-plus concept. Energy-plus means that the building generates more energy annually than it requires for operation. In order to achieve this, the architecture and CO₂-neutral energy generation must be rigorously optimised. The integral planning process, which is essential for fulfilling these aims, also aims to achieve minimum energy consumption, reduced building usage costs with simultaneous high user comfort and an efficient energy and cost performance throughout the entire building lifecycle.



This primary school is an energy-plus building. You can see the focus at intensive use of daylight, sun and glare protection as well as the photovoltaic system. But the building concept even promises more ...

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Building summary

Project status	 In Operation
Location	16540 Hohen Neuendorf, Brandenburg
Completion	10/2010
Inauguration	10/2010
Building owner	Stadt Hohen Neuendorf (+Betreiber und Nutzer)
Gross floor area	7,414 m ²
Gross volume	37,735 m ³
Usable floor area (according to EnEV)	6,563 m ²
A/V ratio	0.33 m ² /m ³
Key aspects	Heat insulation, Facade systems, Glazing + windows, Daylight planning, Daylight systems, Optimised lighting, Ventilation + heat recovery, Regenerative + passive cooling, Combined heat and power generation, combined heating and cooling, Control technology, operational management, building automation, Photovoltaics, Biomass utilisation, Ecology of building materials

Project description

The number of residents in the town of Hohen Neuendorf has doubled in the last 20 years to almost 25,000 inhabitants. Because of its good transport connections and immediate proximity to Berlin, the small town is very attractive for young families. The number of school pupils has also soared. At the beginning of 2008, a feasibility study was commissioned that defined the initial design data and parameters for the new primary school that was required. The new building is situated directly next to an existing municipal sport complex, enabling this to be used for school sports activities. The triple-field sports hall for the future school therefore provides an ideal supplement and enhancement for leisure-based sporting activities the area.

The findings from the feasibility study provided the basis for a European-wide tendering process (as per VOF - official contracting terms for the award of service contracts concerning the freelance professions). In selecting the architects, particular attention was paid to their previous experience in designing energy-optimised buildings.

Building concept

The project intends to show that energy-plus concepts can also be applied to school buildings. The new-build project comprises the construction of a primary school with three parallel classes including an integrated triple-field sports hall. This is intended to provide the optimal constructional prerequisites for a future-proof learning and teaching environment that meets flexible educational concepts and thus provides scope for

developing the quality of the school. This is principally achieved through differentiated, dividable and flexible spaces. The integrated design approach conceives all technical, energy-based and functional requirements as an integral part of the architecture.

The aim is to construct the building envelope to the passive house standard in order to substantially avoid heat losses. Important in this respect is a very good thermally insulated structure with an airtight building envelope ($n_{50} < 0.6/h$) and a balanced relationship between transparent and non-transparent facade surface areas. The building is designed as a solid structure made of reinforced concrete in order to achieve a sufficient thermal storage mass, whereby the facade will be finished with facing bricks. Vacuum insulation panels are deployed in the parapet areas of the south-facing classroom windows, the east-facing specialist classroom windows, and to reduce small-scale thermal bridges.

The daylight concept is based on high daylight autonomy, which is also maintained for the flexible usage scenarios for the teaching spaces. At the same time, the thermal loads are minimised during the summer months. The concept takes into account the different internal (spatial, lighting and design) requirements and responds to the external conditions by developing specific solar shading and daylight systems for the different orientations and internal requirements. Various innovative materials and components are deployed such as Nanogel glazing, micro-structured solar shading glazing, light-diverting and electrochromic glazing.

In the arrangement of sound-absorbing acoustic elements, the room acoustic responds to both the openly revealed solid construction parts as well as the different types of rooms (teaching spaces, sports hall, assembly hall). The image of an energy-plus house is also conveyed architecturally by integrating innovative construction components, whereby these components are intended to be visible and made comprehensible. This becomes clear, for example, through the implementation of various solar shading concepts and the visible ventilation elements.

Energy concept

The parallel development of both an energy and building concept enables the technical building equipment to be fully integrated within the architectural design. In establishing the energy concept, the focus was on deploying natural resources and passive measures to minimise active technical components in accordance with a lean building concept. This considerably reduces the lifecycle costs of the technical systems and the building's energy requirements.

The focuses are:

A building structure with considerable storage mass for free cooling in order to avoid overheating in summer and to increase thermal comfort.

A room concept utilising incident daylight from several sides in order to achieve greater daylight autonomy and thus reduce electricity requirements.

A lighting concept with presence- and room depth-dependent lighting control in order to provide the necessary amount of artificial lighting. The concept envisages a combined use of LED lights and energy-efficient conventional lighting systems.

A hybrid ventilation concept with mainly natural ventilation. Air is only moved mechanically when it makes sense in energy terms or the usage and weather conditions require it. By means of basic mechanical ventilation, the ventilation concept intends to inhibit the build-up of CO₂ content in the classrooms and reduce it to the external air level by means of intermittent ventilation using centrally controlled motorised window casements. Natural night ventilation is intended to counter overheating in summer.

Sustainable energy generation through the combined use of biomass (pellet boiler and pellet-CHP) and solar energy (PV system) in order to achieve CO₂ neutrality and the objectives of the energy-plus concept.

Educational concept

The room concept for the school building is designed to facilitate the use of modern educational approaches within the new primary school. Primary school education no longer views teaching as traditional teacher-centred teaching but as a self-learning process moderated and led by the teacher with specific fostering of individual school pupils or groups, internal differentiation, diverse teaching situations, inter-year groups and active involvement of the school pupils. The teaching is characterised by project work, use of different materials and diverse forms of work.

Performance

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

Optimisation measures and possibilities

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

Construction costs and economic viability

The aim of the concept is to keep the long-term school management costs as low as possible for the local authority. On the one hand the maintenance and servicing costs are minimised by using durable, robust and

low-maintenance construction components and materials, while on the other hand the energy consumption costs are reduced to a very low level. The energy-plus concept also enables a substantial portion of the energy costs to be compensated by the yields from the energy generation. The construction costs are comparable with conventional buildings.

Implementation costs

Costs of implementation in €/m ²	
Construction (KG 300)	767
Technical system (KG 400)	220

These figures represent calculated costs

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

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