

**CASE STUDY:** The Christophorus House - a multi purpose office building with low-energy consumption

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## INTRODUCTION



A multi –purpose office building with low energy consumption for BBM in Stadtl-Paura, Upper Austria.

BBM stands for ( Beschaffungsbetrieb der MIVA ) a non-profit organisation to organise the supply for a developing countries agency. Its main focus lies in ecological water –and energy supply. This ideological background was the motivation for a innovative and ecological optimised concept for a new building for 40 employees. Due to early involvement of a planning team ( architects, woodbuilders, energy-specialists) the decision was made for a multi-purpose office building with storage, retail stores and community service in low energy standard.

The minimum parameters to meet the standard of a “passive office building” were set by the Institute for “Passive house”<sup>1</sup> in Darmstadt. The final (measured) figures proved to be even better due to careful planning by the leading architects Albert P. Böhm and Helmut Frohnwieser .

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<sup>1</sup> Passive house standard: Buildings below 15 kWh/m<sup>2</sup> and year

Heating Energy Figure: 14 kWh/m<sup>2</sup>a

Pressure-test- air -change figure: n50 0,4 h<sup>-1</sup>

Primary Energy Figure : 49 kWh/m<sup>2</sup>a (including power supply for total house technic)

### Architecture and Construction Principles

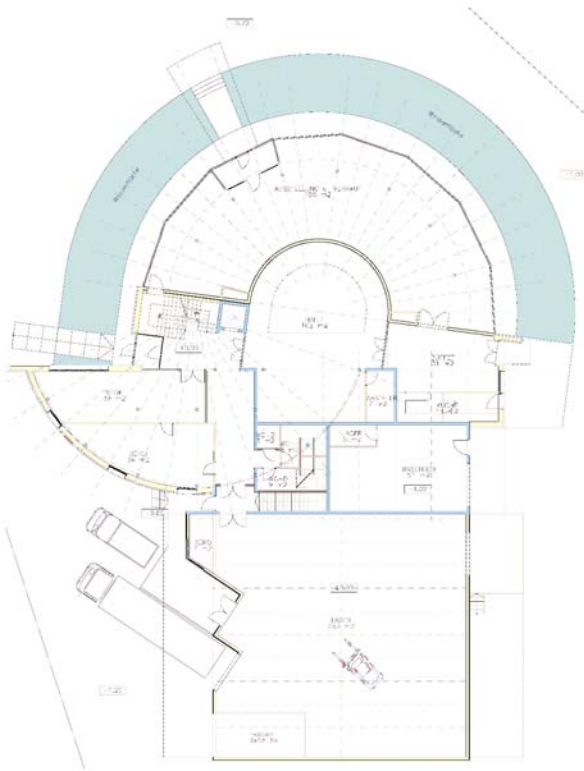
The specification of the site resulted in a circular building form that is divided by regular cubic shape to open up the building. The split into two separate main volumes represents the different functions. The main volume is four stories high and the centre is a glass dome covering the open atrium for all floors and brings down the light to the first floor. This serves also as the entrance to the community centre for 100 people. The storage sector is a separate volume located in the south of the core building including packaging and truck-parking.

The core contribution to reach the goals of a “passive-house” standard is through the use of an innovative wood construction system. The round shape of the building put an extra task to the wood engineers to prevent heat losses.

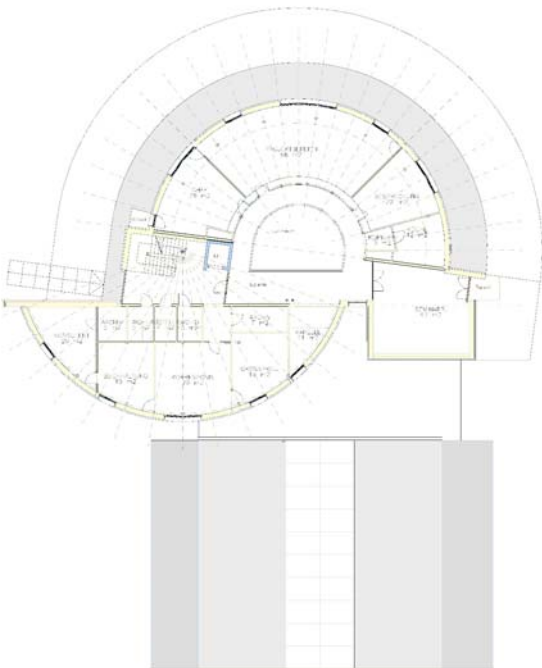
The main structure is wooden frame. The covering walls are not carrying weight. Due to the round shape and its optimised day light use it was possible to have deeper office spaces than in a regular shape. The guiding principles of optimised ecological energy use were the main influence on architecture. This was only possible in a holistic planning process starting in an early stage of the project.



Site plan



*First Floor*



*<sup>2</sup>Second Floor*

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<sup>2</sup> Plan and Picture courtesy of Architects DI Albert P. Böhm, and Mag. Ing. Helmut Frohnwieser A-4020 Linz, Stelzhamerstraße 10

Architecture and the guiding parameters by the Darmstadt "pasivhouse" Institute required a new solution in construction details and building Technology.

The following aspects position this office building as a prototype in the wood building industry:

- curved outer walls in "passive house" standard done as prefabricated elements.
- The building load of 4 stories of an office building are carried by a wood structure.
- Round columns made out of assorted natural rounded trunks instead of expensive and energy consummating Multi Layer wood.
- The weight of the floors is brought into the wooden structure without steel-connectors.

### **Energy concept**

Buildings for housing use most of their energy for heating. Office buildings use their main energy for light, air-conditioning and computer.

The energy consumption is driven by mainly by two factors:

- Quality of the computer and copy machines
- User comfort in the office building such as temperature, day-light, light and quality of air.

This result in the fact, that cooling of an office building can be more energy consuming than heating. Therefore a different concept for low energy consumption is needed.

With the help of energy specialist over the whole planning process the dynamic modelling and simulation was done in TRNSYS. This proofed to be influential to architecture, construction method and detailing.

### **Heating and cooling energy consumption for the whole building [kWh/a]**

Due to dynamic simulation models the team was successful in achieving parameters of 15 kWh/m<sup>2</sup>a and even below for the Heating Energy Figure and a Primary Energy Figure for cooling of 49 kWh/m<sup>2</sup>a. (maximum 80kWh/m<sup>2</sup>a)

The solution for the heating was a heating pump with earth collectors combined with a highly efficient air supply system including heat recycling.

For cooling in summer the system with earth collectors works reverse. The power supply for the heating pump is compensated with a 80 m<sup>2</sup> photovoltaic feature.

### **Recycling of Water**

1. The building has a water basin for collecting the rain water. To maintain the quality of the water a circulation pump is used to bring the water to a biological sand filter with plants.

#### **2. Rainwater collector**

In case of rainfall the overflow of water from both building roofs will be guide over the sand filter to tank. If the maximum level is reached, the water goes into a drainage pit.

#### **3. Gray Water**

The water from the kitchen and the snack bar is collected separately and stored in a grey water tank. A timer brings this water to planted filter basins, and from there is runs to the rain water collector.

#### **4. Rainwater use**

From the drain water pit a pump system brings the water to toilets, helps watering the plants, a is extra supply if there is nor enough grey water. The system for the toilets includes a water watch for exact public fees for water use.

The building with its 2000 m<sup>2</sup> was finished in October 2003. Exact monitoring will help to ensure the quality and to further exchange the knowledge gain in that experiment.