

Housing Project Dresden Pillnitz

Innovative energy concept for two multifamily residences

In Passive House construction

Owners:
Architect:

Bauherriegemeinschaft Nestwerk
Architektengemeinschaft Reiter & Rentzsch – Dresden Tel.: +49 351 88 50 50
architekt@reiter-rentzsch.de

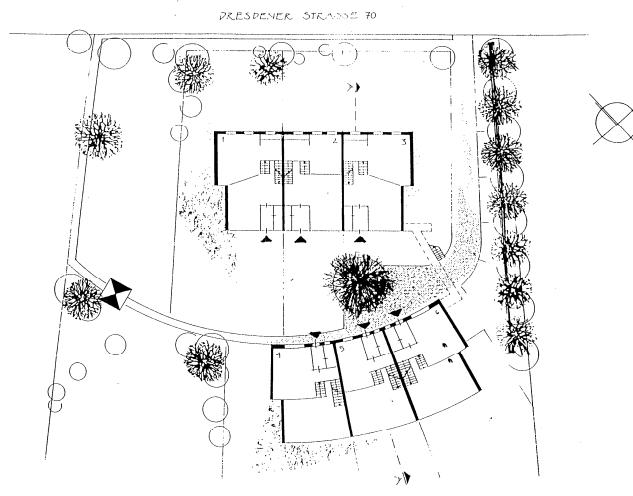
Haustechnik:

Ingenieurbüro Hawemann Solar – Dresden



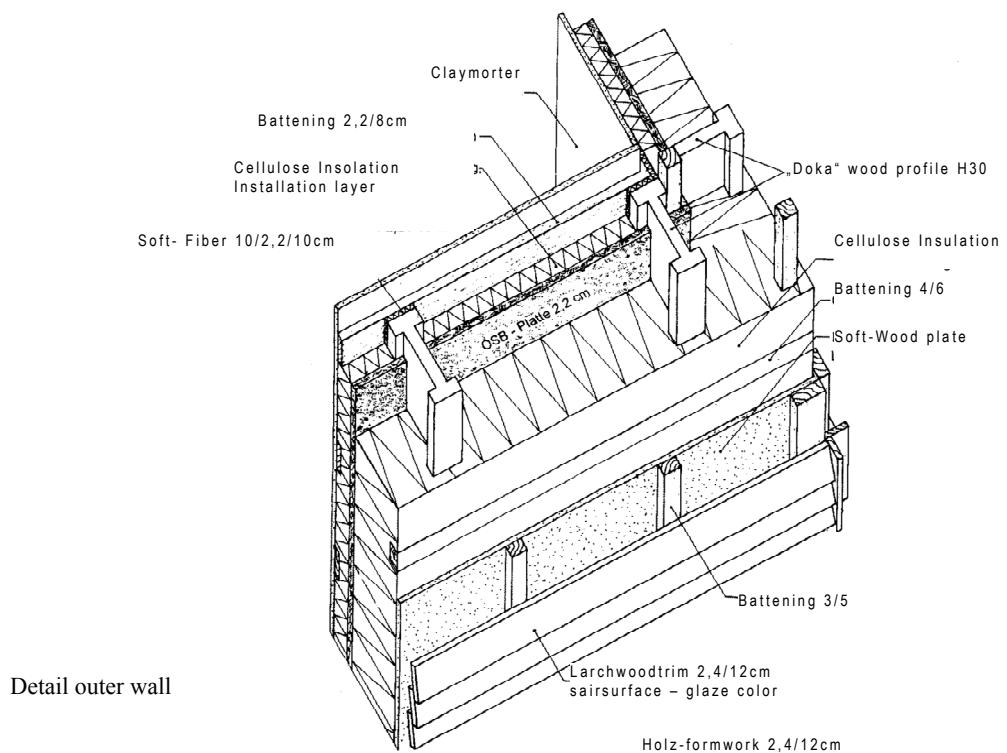
The „Nestwerk Pillnitz“ housing project began in 2000-01 as an idea of 9 self-organised families with a total of 39 members who wanted to build and live together in an ecologically sound manner. A site was found on a sunny south-facing slope near the Elbe and the park of the former royal palace in Pillnitz – an urban location yet in a green setting. Two Passive Houses with a total of 9 apartments were constructed using ecologically sound materials and technology. Two buildings - each consisting of three terraced houses and three loft apartments were built around a shared tranquil atrium garden providing an ideal space for community life. Every apartment also has an adjacent garden as private space. The apartments are sized from 52 m² to 144 m². Built with levels of different heights, the buildings follow the form of the

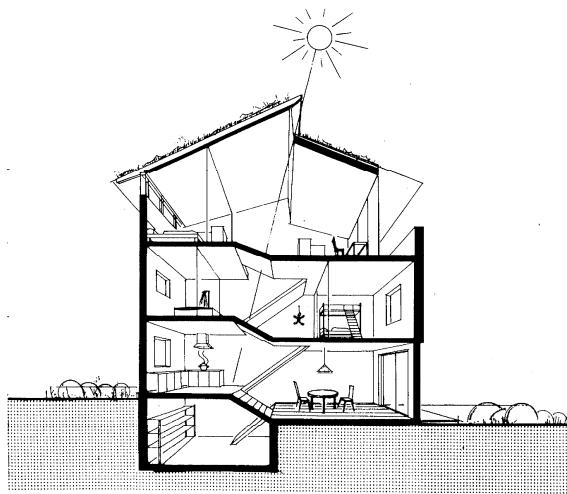
slope. The ground floor is thus made up by a kitchen and a spacious living room comprising two levels with generous room heights. Bedrooms and bathroom are located in the upper stoery. The loft apartments are reached by covered stairs standing separately and extend over one level. Decisions during planning stage as well as during the actual construction were reached in discussions involving the ownership community, the architects and the engineers. A main aim of the owners was to create an ecologically sound and healthy living environment. The energy consumption was to be minimised as much as possible without compromising quality of life. To achieve that, we used the low energy house concept in a more developed form.



The buildings were built in timber-frame construction with healthy building materials. The walls are constructed with "Doka" studwork (timber T profiles, at 1,28m centres) as well as oriented-strand-board which guarantees stiffness and air tightness. The outer walls (three stories high) were made in one piece and then raised up to be subsequently attached to inner walls and floors, thus guaranteeing an air-tight façade. The walls were then insulated with cellulose (over a width of 37 cm) which is a product of recycled newspapers and achieves $u=0,11 \text{ W/m}^2\text{K}$. The green roof was insulated with 34cm of cellulose ($u=0,12 \text{ W/m}^2\text{K}$). Deepened roof battens form the protruding eaves.

Towards the partial basement (or ground level) the required energy conservation is achieved by crossing boards with an insulation of 30 cm. The total area of windows surface was reduced to 30 % to avoid overheating the buildings in summer. The wood windows have three pane energy- efficient glazing and insulated frames, which achieve $u= 0,85 \text{ W/m}^2\text{K}$ and a $g= 44\%$ (only the timber of the cills is chemically treated). The materials to complete the structure were chosen to meet high ecological standards. Almost no chemical wood protection was used. Painting inside as well as outside was done using natural colour. Pigments joints were sealed with cotton wool and flaxes. Clay was added in places to enhance the timber construction. A green roof and rain water use complete the concept.





Energy

The elements of the energy concept are an automatic ventilation system with air heating in every apartment, solar panels (12m^2) on every house with interim storage of a thousand litres and gas central heating. The legal division of the apartments and the individual floor layouts were accountable for the decision to instal separate ventilation systems (with attached ground heat exchanger) in each apartment. Additionally, a heated towel rail was installed in the bathrooms, as well as 3m^2 of heating pipes embedded in the living room wall. These were installed solely for comfort, to allow the users to feel warmth on cold and unpleasant days.

The heating is distributed in insulated double pipe assemblies that are commonly employed in solar technology. The interim storage takes heating from both solar panels and the community gas boiler. The gas boiler with a performance of 36 kW was designed for warm water heating. The times required to heat up the water were considered. The total remaining required energy of both houses is 8 kW, calculated on the basis of PhPP. The remaining required heating energy of the apartments lies between 650W and 1600A. There are performance reserves for higher temperatures.

As per wish of some owners, a solution was to disconnect the master bedroom from the air circulation. To achieve this, the doors were completed with four sided sealing. The incoming air and the soundproofed overflow openings can be separately locked. Thus the room temperature can sink and an opened window at night does not cool the apartment.

	EP	GP
KG 200 - Erschließung	EUR	6 800
KG 300 - building	EUR	1043 500
KG 400 - technology	EUR	208 500
Heating, solar installations	EUR	52 900
Sanitary installations	EUR	59 900
Air circulation	EUR	59 300
Electric installations	EUR	27 100
Erth warmth exchange	EUR	9 300
Total costs	EUR	1258 800
Specific Costs	EUR/m²	1 345
Percentage technology		17%
Percentage of heating, solar		
Air circulation installations		9%

Overview 1: building costs; EP is price per craft, GP is total price

Building costs

The building costs including connecting media and earth exchange were 1345 EUR/m². The house technology installations (sanitary, electric, heating, air circulation) comprise about 17 %. Only regarding heating and air circulation, this part is about 9% (see overview 1).

Based on these figures, a comparison with a low-energy house and the project's dynamic rentability was calculated. A comparable user comfort was assumed, in this case solar collectors and ventilation system. The running costs were based on an offer by the install company. Per year and apartment the costs are 316 EUR, the different maintenance cycles considered. 75% of costs are due to the ventilation system. The largest portion – 118 EUR – is the exchange of the filter in the outside air filterbox where a lifetime of one year was assumed. As listed in overview 2, the running costs are 1,60 EUR/m²a. The rentability calculation takes the installation costs of the energy technology and the increased construction costs of a Passive House (wood construction, insulation, windows and doors) into account. The increased building costs are about 5% of the total costs. Over a period of 20 years, taking a capital increase of 10% p.a. into account, the Passive House has an equal cost balance compared to the low-energy house (see overview 3).

Running costs	Costs per year je WE	Costs per year Je m²
Heating and Solar	78,37	0,75
Ventilation system	238	2,29
Usages costs	166,11	1,6
Sum	482,48	4,64
Living unit of 100qm		464

Overview 2: running costs

Conclusion

The further development of the Passive House should in our opinion aim to be a complete ecological concept, solely saving energy is not sufficient. Thus an ecological Passive House is the goal. The architectural ambitions of the owner are not hampered by the idea of the Passive House. The first wish is a beautiful, comfortable house, then one with little energy consumption. Eaves, the composition of structures, large window openings in the living area, even round buildings are easily realised with some planning effort. The amount of design does increase: about 80 details were drawn for this building. The invisible air circulation ducts especially, demand a lot of thought in advance.

After initial scepticism, the owners are delighted with the living qualities of Passive Houses. Combining this with the idea of building as a community has proved to be practicable. In the next 2 years the structures will be measured to chart the energy consumption, as user behaviour remains the key determining factor on the results.

	Passive House		Low House	Energy
Investment				
Investment Energycosts	116 200	EUR	124 800	EUR
Livespan	20	Jahre	20	Jahre
Surplus investment building costs	69 000	EUR	0	EUR
Life span	60	Jahre	60	Jahre
Sum investments	185 200	EUR	124 800	EUR
Barwert beginning	170 857	EUR	124 800	EUR
Capital costs (Annuität)	14 896	EUR/a	10 881	EUR/a
Energy consumption				
User energy consumption	19 260	kWh/a	53 900	kWh/a
Base costs electricity	2 600	kWh/a	3 000	kWh/a
gas	23 851	kWh/a	63 041	kWh/a
Costs depending upon usage				
Increase in energy prices 10 % /a				
Base costs electricity	0,158	EUR/kWh	0,158	EUR/kW h
gas	0,0452	EUR/kWh	0,0452	EUR/kW h
usage electricity	983	EUR/a	1 134	EUR/a
gas	2 579	EUR/a	6 817	EUR/a
Energiekosten (Annuität)	3 562	EUR/a	7 951	EUR/a
Running costs of installments				
Costs increase 5 % / a				
Heating costs	705	EUR/a	1 743	EUR/a
Ventilation system	2 142	EUR/a	670	EUR/a
Repare costs	1 162	EUR/a	1 248	EUR/a
Running costs (Annuität)	6 036	EUR/a	5 512	EUR/a
Total costs	24 495	EUR/a	24 344	EUR/a
Total costs per year	26,17	EUR/m³a	26,01	EUR/m³a

Regarded over a time span of 20 years, interest rate 6%, Annuitätenfaktor 0.087

Overview 3: rentability

Authors:

Architectural Association Reiter und Rentzsch
Moritzburger Weg 67, D-01109 Dresden
Tel.: 0049(0)351/885050,Fax: (0) 351/88 50 517
E-mail: architekt@reiter-rentzsch.de

Engineers HAWEMANN SOLAR
Am Jacobstein 30a, D-01445 Radebeul
Tel.:0049(0)351/885060,Fax:(0)351/8850 617
E-mail: info@hawemann-solar.de