

# **PRESERVATION OF THE HISTORIC STOCK IN PASSIVE HOUSE REFURBISHMENT**

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## **Summary**

A villa from the end of the nineteenth century was renovated in a suburb of Vienna. Both the regal interior rooms (proportions) and the external appearance (heritage protection) were retained. At the same time, heating consumption was reduced to 20 kWh/(m<sup>2</sup>a) through the use of insulation, new windows, airtightness, heat recovery in the ventilation system, and other details. In addition to the renovations, new buildings were constructed, and a joint system of 60 square meters of solar thermal collectors, a biomass-fired heating system, and a central 3500-liter buffer tank covers the remaining heating energy demand.

**Keywords:** Renovation, Passive House, Solar Hot Water and Heating, Biomass Heating, Building preservation

## **1 Renovation concept**

**Attic:** The pitched roof had seen better days and was removed and completely replaced with glued laminated timbers with 30 centimeters of external insulation. The new attic has space for two new apartments.

**External insulation:** The relatively simple structure of the prefabricated façade before renovation was documented in detail before most of it was taken down. Twenty-six centimeters of composite insulation was added to the entire façade, which enlarged the building by roughly six percent. An attempt was made to replicate that six percent increase with all components (including roof, building height, etc.) so that the building would retain its overall appearance. The original plaster was re-created, including the color of the lime plaster, to the extent possible.

**Windows:** The character and position of the windows were retained because they are so essential to the building's appearance and character. Overall, three different types of windows were used:

**Prestigious south-facing windows (box-type windows):** Here, the outermost wings were renovated and moved a bit farther outwards to retain their position at the outer level of the façade. The insides of the casements were also renovated and equipped with insulated glass on the outside so that the appearance remains the same inside the building. The overall window construction attained the Passive House value ( $uw=0.85$ ).

**North-facing box-type windows:** These windows were in very poor shape on the outside and were not as high-quality as the southern windows. The inside casement (including wooden shutters) was retained, but a modern window was added to the outside. As in the

historic state, the outside wings open to the outside (i.e. the appearance was maintained). Overall, Passive House values were also reached with these windows ( $uw=0.85$ ).

**Windows in the attic and new windows:** The windows in the old attic had recently been renewed. They were replaced with new, high-quality windows in the same positions ( $uw=0.85$ ). The same technology and positions were used for new windows (to get more light, since the villa was originally only used in the summer and therefore had little daylight).

**Basement and floors touching the ground:** The building only has a basement on parts of the northern side. On the ground floor, all of the flooring was lifted so that a new substructure could be created (22 centimeters of insulation). The old wooden floor was largely reused. External, horizontal insulation plates were installed in an attempt to keep heat losses via the foundations low. The walls of the basement were insulated halfway up on the outside.

**Apartments:** The apartments on the ground floor and first floor (each with around 180 square meters) were retained. The prestigious large southern rooms were kept the same. On the northern side, where the workrooms were traditionally located, the pre-existing structure was not retained as much; rather, modern lavatories, kitchen areas, and storage rooms were installed, and the ceilings were suspended in places to cover the lines. The general entry area was also moved.

**Ventilation:** Each of the four apartments has its own ventilation device in the lavatory area near the external wall (Drexel & Weiß).

**Heating, hot water:** Each apartment has a two-line system for hot water and heating (radiators and an instantaneous heater with a hot water tank) so that only one meter per apartment is required.

**Southern veranda:** Unfortunately, the owner of the building dismantled a very attractive southern veranda made of wood roughly 25 years ago. The original plan to restore this veranda with a glazed version resembling a conservatory was not possible because of the expense, so a steel veranda was built without any glazing. In the lounges and in the hall acoustic ceilings are implemented. The roof is planted, so that together with the new planting there is around the same amount of vegetation after the construction is finished than it was before. The walls are insulated with rock wool and covered with larch planking.

The flat roof is on EPS / XPS insulation and vegetated with generous green areas. The supply and disposal is provided via a groundwater heat pump, the public electricity and water supply through the public network. The rain water is made to percolate through dells on the site.

## **2 Result, summary**

The project attained an annual energy consumption of around 20 kWh/ m<sup>2</sup>a. This value is slightly higher than the limit for new Passive Houses, because of the higher ceiling in the old building and a number of details that could not fulfill the Passive House Standard,

especially in the basement and around the foundations. Calculations revealed that the conservatory would have made up for this extra energy consumption had it been automatically included in the ventilation concept. Nonetheless, the ecological footprint of the house is very good (thanks to “gray energy”, the active use of solar, and the use of biomass) and even exceeds a number of modern Passive Houses.

### **3 References and support**

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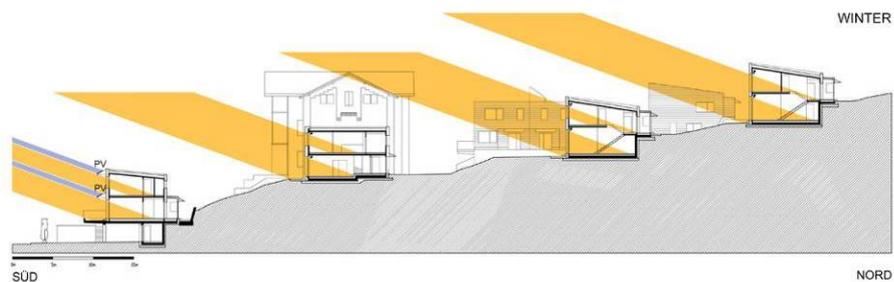
**Fig. 1** before reconstruction



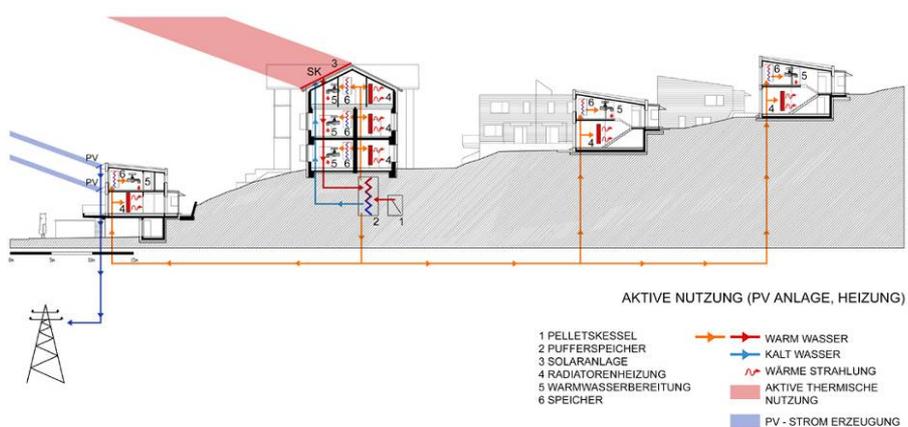
**Fig. 2** after reconstruction



**Fig. 3** Entrance



**Fig. 4** Winter, north



**Fig. 5** Energy concept



**Fig. 6** Attic



**Fig. 7** Interior Quality