Single family house in Pettenbach AT

PROJECT SUMMARY

Renovation of a summer residence (built in 1962) with new facade elements and a storey was added. 98% reduction of primary energy demand. Complies with Passive House requirements.

SPECIAL FEATURES

- central mech. ventilation system with heat recovery and air heating
- vacuum insulation panels
- photovoltaic panels

PLANNER

Lang Consulting
Ing. Günter Lang, Mathias Lang

OWNER

Gabriele u. Ing. Werner Schwarz
Private

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

IEA – SHC Task 37
Advanced Housing Renovation with Solar & Conservation

Before

After

BACKGROUND

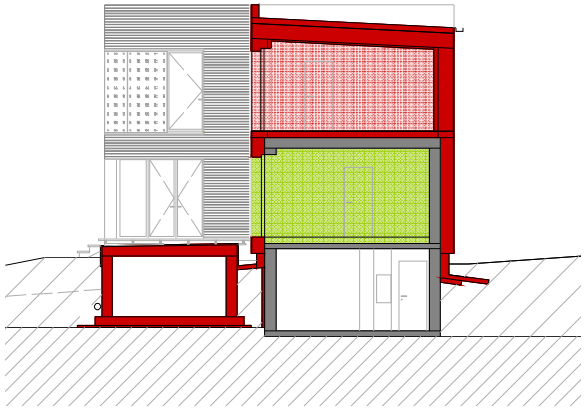
The exterior of this summer residence, built in 1962, was in a poor condition. The exterior walls of wood chip concrete were uninsulatied and the original windows still in place. In 1980 a small extension including a basement was completed. A central gas boiler supplies space and domestic hot water heating. The space heating demand was 367 kWh/(m²a).
A young family renovated the house in 2005 and it now complies with the Passive House requirements, needing only 12 kWh/(m²a) for space heating. The renovation was subsidized by the program 'House of the Future' from the Austrian Ministry of Transport, Innovation and Technology (BMVIT).

OBJECTIVES OF THE RENOVATION

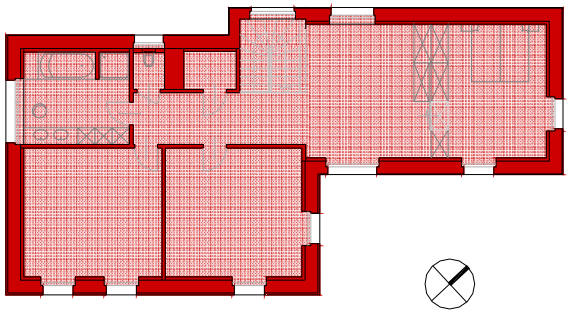
- minimize heating costs
- optimize ventilation and building services
- ecological renovation with renewable resources
- high degree of pre-fabrication
- meet the Passive House Standard

SUMMARY OF THE RENOVATION

- Insulation: roof (355 mm), facade (440 mm) basement ceiling (440 mm)
- vacuum floor insulation (20 mm)
- prefabricated hook-in timber wall
- windows meeting Passive House requirements
- enhancement of the ground floor layout
- photovoltaic panels
- central mech. ventilation system with heat recovery and air heating



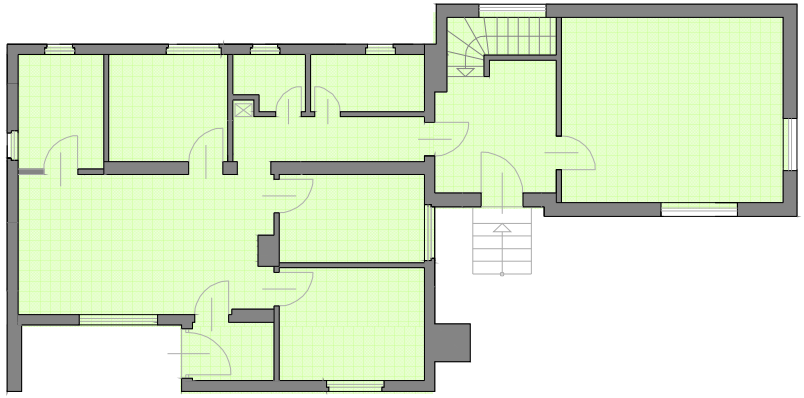
Section



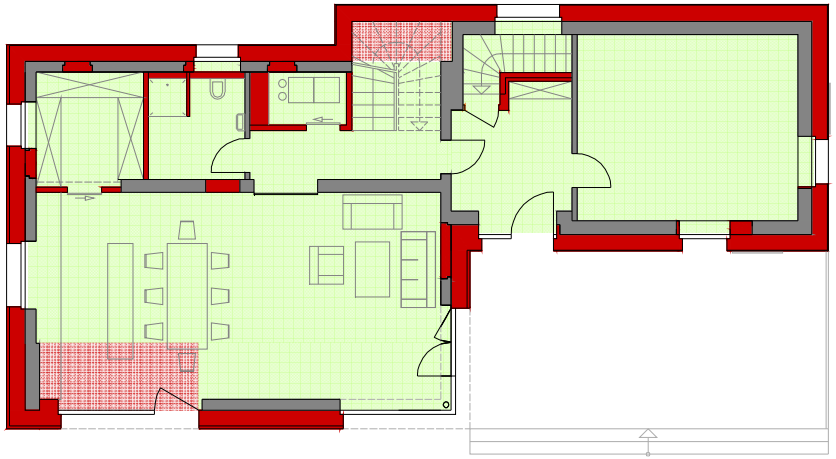
Second floor plan

Renovation
Lasting quality

The renovation should be of lasting quality and only the most essential demolition work done (the roof and some of the room partitions).
To respond to a modern living style, it was necessary to consolidate rooms on the ground floor to create more open space. The result was a generous area with an open kitchen.
Before the renovation, most rooms were dark because of the small windows. The availability today of high thermal quality windows made it possible to increase the window area and hence daylighting of the rooms. The south facing façade corner was opened to visually extend the interior space out to the terrace and garden.



Ground floor before renovation



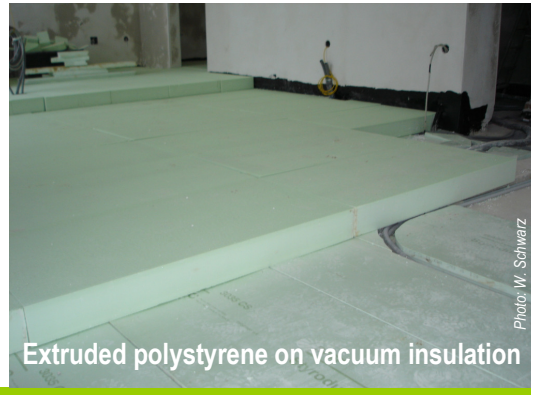
Ground floor after renovation

HOOK-IN TIMBER WALL CONSTRUCTION

The encasement of the ground floor is a key aspect of this innovative rehabilitation concept. Adapted to the existing building, suspension points were determined and the hook-in framing parts preinstalled for the prefabricated wall elements. The planning was all done in 3-D CAD.
Installation of the façade elements and windows went smoothly and were completed during the first day. The insulation material used was cellulose, which evens out irregularities between the new wall elements and the existing building and leaves no joints for air leakage.

VACUUM INSULATION

Vacuum insulation was used for the floor, given the limited head room. It was protected by an additional layer of polystyrene insulation. This made possible a very good insulation with a minimal thickness.

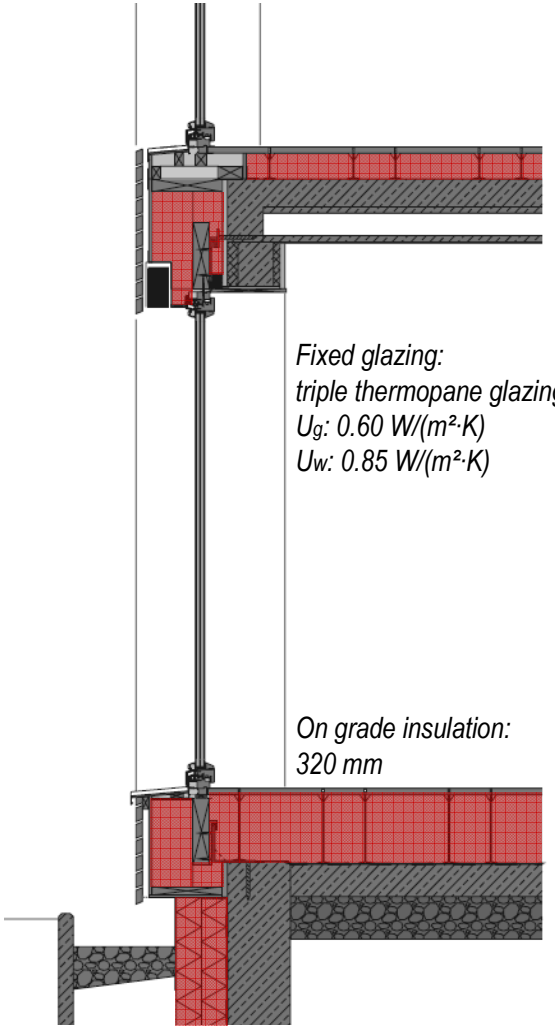


CONSTRUCTION

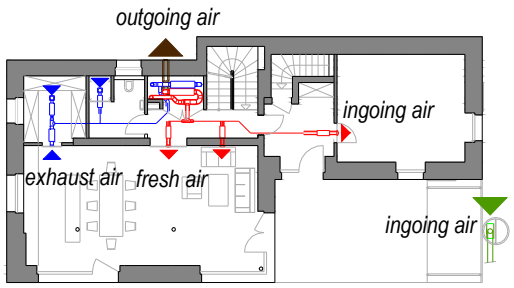
Roof construction	*U-value: 0.094 W/(m²·K)*
(interior to exterior)	
plasterboard	13 mm
mineral wool insulation	40 mm
OSB airtight	16 mm
cellulose insulation	440 mm
softboard	15 mm
roof covering with air space	80 mm
Total	604 mm

Wall construction	*U-value: 0.112 W/(m²·K)*
(interior to exterior)	
lime plaster	15 mm
wood chip concrete	250 mm
lime plaster	25 mm
cellulose insulation	355 mm
softboard	16 mm
air space	45 mm
wood boards	30 mm
Total	736 mm

Basement ceiling	*U-value: 0.132 W/(m²·K)*
(top down)	
parquet	16 mm
floor screed	50 mm
extrude polystyrene	80 mm
vacuum insulation	20 mm
reinforced concrete floor	300 mm
extrude polystyrene	50 mm
Total	516 mm



Window section - ground floor



Central ventilation system

Summary of U-values W/(m²·K)

	Before	After
Attic floor	1.2	0.09
Walls	1.0	0.11
Basement ceiling	0.5	0.13
Windows	ca. 2.6	0.85

BUILDING SERVICES

The building meets the requirements of a Passive House by means of the added insulation of the top storey and cellar ceiling, prefabricated highly insulated hook-in timber walls, reduction of thermal bridges, triple glazed windows and an air tight envelope.
A new compact central mechanical ventilation system with 86% heat recovery combined with an air/air heat pump was installed. An earth to air heat exchanger preheats intake fresh air. The remaining heating energy demand is covered by electricity with low temperature radiant heating panels.
The expected energy savings of about 56,000 kWh/a will decrease annual CO_2 emissions from about 14.000 kg to 1.200 kg.

RENEWABLE ENERGY USE

The 2.4 kWp photovoltaic panels integrated into the facade can cover 60% of the auxiliary electric heating demand.

ENERGY PERFORMANCE

Space + water heating (primary energy)*
Before: 548 kWh/(m²a)
After: 13.4 kWh/(m²a)
Reduction: 98 %

*according to OIB Richtlinie 6

INFORMATION SOURCES

The very first Austrian reconstruction of a single family house to the Passive House Standard (Model project in Pettenbach/Upper Austria), report of energy end environment research 38/200/, bmvit

Family Schwarz

Brochure authors
S. Grünewald, S.Rottensteiner

Contact
Thomas Mach
thomas.mach@tugraz.at