One-Family House in Walenstadt, CH

PROJECT SUMMARY
Housing renovation
and addition of a room
Reduction of heating energy: 80%

SPECIAL FEATURES
Solar drain-back-system
Contemporary design character

ARCHITECT
Architecture office FEBI
www.febi.ch

OWNER
Hubert Fehr, Architect FEBI

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

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

Before

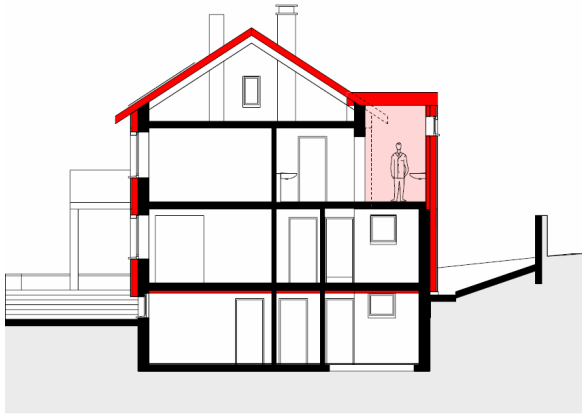
After

BACKGROUND

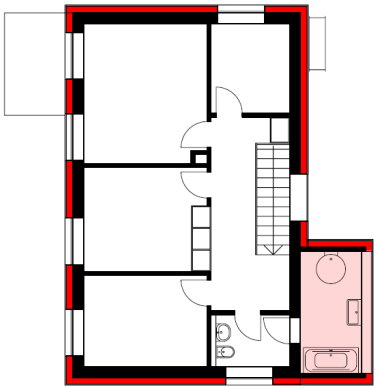
This single-family house from 1942 was purchased by a young couple in 1997. Three years later the oil furnace had to be replaced. This was an incentive to develop a completely new energy concept for the house. The owner, an architect, achieved a sustainable renovation during the following five years. He achieved an 80% reduction in heating energy demand while drastically improving the living standard.

SUMMARY OF THE RENOVATION

- Insulation of the building envelope: roof (220 mm), façade (200 mm) basement ceiling (80 mm).
- New triple glazed windows (U-value glass: 0.5 W/m² a, g-value: 0.55).
- New roof cladding.
- 13 m² solar collectors, 800 litre combi-tank.
- Wooden pellet furnace (3 kW) as replacement of the oil heating (11 kW).
- New ventilation system (HRC 80%).
- Addition of a bathroom.



Section



Floor plan

CONSTRUCTION

Roof construction *U-value: 0.18 W/(m²·K)*

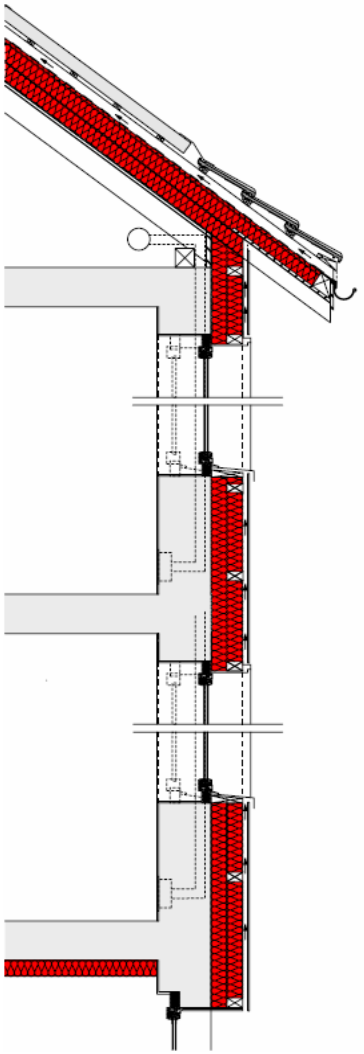
(from top to bottom)	
Roof tiles / solar collector	100 mm
Wooden strapping	24 mm
Air gap, wooden cross strapping	60 mm
Weatherproofing paper	
Mineral wool insulation	220 mm
Weatherproofing	
Roof planking (tongue and groove)	19 mm
Rafters (existing)	180 mm
Total	603 mm

Wall construction *U-value: 0.19 W/(m²·K)*

(interior to exterior)	
Interior plaster	15 mm
Masonry wall (existing)	330 mm
Mineral wool insulation	200 mm
Air gap, wooden cross strapping	30 mm
Eternit cladding	8 mm
Total	583 mm

Basement ceiling *U-value: 0.37 W/(m²·K)*

(top to bottom)	
Parquet flooring	15 mm
Chipboard	30 mm
Wooden beams, false floor	
partial insulation with cellulose. (existing)	200 mm
Reed-Plaster ceiling (existing)	20 mm
Mineral wool insulation	80 mm
Total	345 mm



South façade (new insulation in red)

Summary of U-values W/(m²·K)

(W/m²K)	Before	After
Roof	0.80	0.18
Walls	1.15	0.19
Basement ceiling	0.90	0.37
Windows*	2.6 - 3.0	0.8 - 1.1

* including frame

BUILDING SERVICES

Before the renovation, this single-family house needed 3,500 litre of heating oil per year, or the equivalent of seven tons of wooden pellets. Today, after the renovation of the building envelope and replacement of the oil furnace with a wooden pellets furnace 1½ tons are sufficient. A new ventilation system with heat recovery (efficiency 80%) and rotating heat exchanger were installed. The ventilation system's electrical consumption amounts to 4.5 kWh/m²a. The fans have 99 W connected power.

RENEWABLE ENERGY USE

13 m² of solar flat plate collectors on the roof with an 800 litre storage tank cover 100% of the hot water demand in summer and help considerably to meet the space heating energy demand during fall and spring. The drain-back-system prevents the system from overheating.

ENERGY PERFORMANCE

Space + water heating (primary energy)*
Before: ca. 230 kWh/m²
After: 47 kWh/m²
Reduction: 80 %
*Swiss Standard: SIA 380/1: 2001

INFORMATION SOURCES

Enz, D.: *Bauerneuerung für die Zukunft,* Flumroc AG, Postfach, CH-8890 Flums, 36 pages (German, French, Italian) www.flumroc.ch
March 2007

Brochure co-authors

daniela.enz@aeu.ch
robert.hastings@aeu.ch