Owner
Hubert Fehr, Architect FEBI

Architect
Architecture office FEBI
www.febi.ch

Special Features
Solar drain-back-system
Contemporary design character

Project Summary
Housing renovation and addition of a room
Reduction of heating energy: 80%

One-Family House in Walenstadt, CH

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

#### Roof construction  \[ U\text{-value: 0.18 } W/(m^2\cdot K) \]
(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  \[ U\text{-value: 0.19 } W/(m^2\cdot K) \]
(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  \[ U\text{-value: 0.37 } W/(m^2\cdot K) \]
(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)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roof</td>
<td>0.80</td>
<td>0.18</td>
</tr>
<tr>
<td>Walls</td>
<td>1.15</td>
<td>0.19</td>
</tr>
<tr>
<td>Basement ceiling</td>
<td>0.90</td>
<td>0.37</td>
</tr>
<tr>
<td>Windows*</td>
<td>2.6 - 3.0</td>
<td>0.8 - 1.1</td>
</tr>
</tbody>
</table>

* including frame

**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

**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.

**INFORMATIONOURCES**

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