PROJECT SUMMARY
Renovation and addition exceeding Swiss Minergie-P Standard. Use of Solar thermal, PV and geothermal.

SPECIAL FEATURE: PV primary energy production exceeds total energy consumption for heating, warm water and appliances!

ARCHITECT:
Architecture office Rolf Wenger, CH 3072 Ostermundgen
www.archwenger.ch

ENERGY CONCEPT:
E plus U, CH 3000 Bern 23
www.elpsuc.ch

OWNER: Priska + Christian Zeyer

SFH Zeyer in Ostermundigen CH

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

Old house completely renovated and new living, kitchen and entry areas added. New geothermal heating, heat recovery ventilation, installed, solar collectors and roof integrated pv panels. Result: a modern house achieving highest energy standard.

SUMMARY OF THE RENOVATION

Existing wall insulation stripped away and replaced with 2 160mm layers of polystyrol as a "compact façade". New roof trusses added to the roof to create a 420 mm void for cellulose insulation.

Vacuum insulation used over window roll blind boxes and on the floor where no cellar.

New addition is wooden construction with large windows for light and passive solar gain. 80 mm poured concrete floor increases the passive solar usability. Also, ventilation system with heat recovery distributes passive solar heat throughout the house.
**CONSTRUCTION**

**Roof construction**  
*U-value: 0.1 W/(m²·K)*
- Roof tiles
- Wood battens: 30 mm
- Counter wooden battens: 60 mm
- Under-roof panels: 35 mm
- Cellulose fiber Upsi-T300mm: 420 mm
- Wooden roof rafters: 120 mm
- Vapor barrier
- Interior finish
- **Total**: 685 mm

**Wall construction**  
*U-value: 0.1 W/(m²·K)*  
*(interior to exterior)*
- Wooden board paneling: 15 mm
- Wooden battens: 30 mm
- Masonry wall (existing): 300 mm
- Polystyrol: 320 mm
- Exterior plaster: 10 mm
- **Total**: 675 mm

**Basement**  
*U-value house to earth: 0.10 W/(m²·K)*
- **Ceiling**
  - Concrete slab: 200 mm
  - Polyurethane
- **Foundation**
  - Walls: 300 mm
  - Exterior Styrofoam to 400 m depth: 280 mm
Roof construction

Existing roof covered with vapour barrier glued to wall vapour barrier.
Above existing roof new wooden trusses with wooden fiber deck. Cellulose (Isofloc) blown in the void.
New wooden bats carry roof tiles or roof-integrated pv.
Solar:
Roof-integrated PV system with 6.6 kWp
5 m² solar thermal collectors on stand
Summary of U-values W/(m²·K)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attic floor</td>
<td>1.2</td>
<td>0.10</td>
</tr>
<tr>
<td>Walls</td>
<td>1.0</td>
<td>0.10</td>
</tr>
<tr>
<td>House to ground</td>
<td>0.9</td>
<td>0.1</td>
</tr>
<tr>
<td>Windows</td>
<td>2.5</td>
<td>0.8*</td>
</tr>
</tbody>
</table>

* Varies by window size from 0.6 to 1.2

BUILDING SERVICES

- Intake fresh air is warmed and humidified by an enthalpy heat-exchanger which recovers room humidity as well as heat (nominal 90% efficient)
- Heat delivered to by radiant ceilings ground floor rooms, radiant floors of 1st floor rooms. Supply temperature 30 °C by -8 °C ambient
- Heat produced by a heat pump coupled to a 150 m deep borehole
- Solar thermal collectors are mounted on stands on the house addition

RENEWABLE ENERGY USE
PV roof integrated: 6.6 kWp
Solar collectors: 5 m²

ENERGY PERFORMANCE
Space + water heating (primary energy)*
Before: 164 kWh/m²
After: 34 kWh/m² **
Reduction: 80 %
Net Energy Production 10 kWh/m² ***

* Swiss Standard: SIA 380/1: 2001
** New living area after the renovation 30 % larger
*** Primary energy balance. PV output > heating, hot water and appliance energy consumption.

INFORMATION SOURCES
Christian Zeyer, E plus U Energie- und Umweltberatung GmbH, Monbijoustrasse 61, CH-3000 Bern 23

Brochure author
Robert Hastings
AEU Ltd., Erikastrasse 18, CH-8304 Wallisellen