PROJECT SUMMARY
Modernisation of a single family house with a solar facade

SPECIAL FEATURES
Passive solar façade reducing heat loss by 80%, mech. ventil. with h.r. and earth register, 4.9 kWp PV

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

The home owner wished to have more living space and at the same time reduce energy consumption. The solution was to add on a bathroom and wc, and convert the attic to living space, increasing the area from 95 to 256 m². The energy consumption was reduced with a solar façade, mechanical ventilation with heat recovery and additional pv panels were added. The total cost of the renovation was €200,000.

SUMMARY OF THE RENOVATION

• Addition of a bathroom + wc and attic converted to living space
• Solar façade (Lucido System)
• Roof insulation with 320 mm (wood + cellulose fiber)
• Ventilation hr + - ground to air heat exchanger
• PV added bringing total power to 4.9 kWp
ADDED EXTERIOR WALL CONSTRUCTION

U-value: 0.08 W/(m²·K)
(dynamic U-value over heating season)

2 Solar glass 4 mm
3 Air gap 16 mm
4 Slotted wooden solar absorber, 40 mm
5 Wind barrier paper
9 Wooden lathing with
   cellulose-wood fiber insul between 100mm
11 Wind barrier paper and
   existing wall behind

Total added wall thickness 160 mm

Wall and window section
**ROOF CONSTRUCTION**

- **U-value:** 0.13 W/(m²·K)

<table>
<thead>
<tr>
<th>Step</th>
<th>Component</th>
<th>Thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Wooden battens</td>
<td>60 mm</td>
</tr>
<tr>
<td>5</td>
<td>Cellulose-wood fiber decking</td>
<td>22 mm</td>
</tr>
<tr>
<td>6</td>
<td>Insulation (same as above)</td>
<td>140 mm</td>
</tr>
<tr>
<td>7</td>
<td>Insulation (same as above)</td>
<td>160 mm</td>
</tr>
<tr>
<td>9</td>
<td>Wind barrier and ceiling compost bd</td>
<td>20 mm</td>
</tr>
<tr>
<td>10</td>
<td>Existing wooden rafters</td>
<td>180 mm</td>
</tr>
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**Total:** 582 mm
The solar facade, Lucido®, absorbs and stores solar energy to create a warm buffer between the house and the ambient, reducing wall heat losses.

1) **Solar glass**: (4 mm typical). This traps the heat in the buffer space behind the glass and protects the wooden absorber from weather.

2) **Air gap**: (16 mm typical) Openings at the top and bottom allow the construction to "breathe" and dissipate any condensation.

3) **Absorber | heat storage**: The 40 mm absorber is massive wood. Slits are routed out of the wood to create horizontal louvers sloping inward and upward. Certified quality fir or larch wood is used.

The facade appearance can, if desired, be left in natural wood. It will not turn gray like exposed facades, because it is protected behind glass.
Summary of U-values W/(m²·K)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
</tr>
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<tbody>
<tr>
<td>Attic floor</td>
<td>0.60</td>
<td>0.13</td>
</tr>
<tr>
<td>Walls</td>
<td>0.40</td>
<td>0.08</td>
</tr>
<tr>
<td>Basement ceiling</td>
<td>1.20</td>
<td>0.18</td>
</tr>
<tr>
<td>Windows’</td>
<td>2.20</td>
<td>0.80</td>
</tr>
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RENEWABLE ENERGY USE

A PV system was mounted on the roof totalling 4.9 kWp (20m² in 2005, 15m² in 2008).

ENERGY PERFORMANCE

Space + water heating (primary energy)*
Before: 107 kWh/m²
After: 24 kWh/m²
Reduction: 77%

BUILDING SERVICES

A mechanical ventilation system with a stainless steel earth heat exchanger and 85% heat recovery.

Space and domestic water heating by an ground coupled heat pump.

Electricity use and production in 2006:
- 2 467 kWh PV Production
- 2 662 kWh HP consumption

INFORMATION SOURCE

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