PROJECT SUMMARY
Renovation of an apartment building, built in the 1960s. 94 % reduction of annual heat energy demand: (according to PHPP). Complies with Passive House Standard

SPECIAL FEATURES
Decentral mechanical ventilation with heat recovery. PV

ARCHITECT
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Apartment building “Schlesierstraße” in Ludwigshafen, DE

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

The apartment building Schlesierstraße 25 - 29 in Ludwigshafen, DE was built in the 1960s. 18 apartments, each 53 m², had to be renovated. The building envelope was typical for the time when built, with a heating energy demand of 322 kWh/m²a. After refurbishment in 2008 the building complied with Passive House Standard and achieved an annual heat energy demand of 14 kWh/(m²a) as calculated by the Passive House Planning Package (PHPP).

SUMMARY OF THE RENOVATION

- exterior insulation and finish system
- insulation of basement and attic ceiling
- passive house suitable windows (triple glazing)
- reduction of thermal bridges (eaves, verge, plinth)
- decentral mechanical ventilation with heat recovery
- new electric and sanitary installation
- improvement of the floor plan creating 15 apartments of different sizes (56 m² - 93 m²), making use of parts of the former balconies
- demolition of the existing balconies and construction of new stand-alone balconies.
Reduction of thermal bridge at the eaves ($\psi = 0.04 \text{ W/mK}$).
(source: PHI)

Reduction of thermal bridges by removing existing balconies. And construction new stand-alone balconies.

CONSTRUCTION

Roof construction $U$-value: 0.09 W/(m²·K)
(top down)
- chipboard: 20 mm
- expanded polystyrene: 240 mm
- expanded polystyrene (existing): 140 mm
- standard concrete (existing): 130 mm
- plaster (existing): 20 mm
- total: 550 mm

Wall construction $U$-value: 0.11 W/(m²·K)
(interior to exterior)
- interior plaster: 20 mm
- vertically perforated brick (existing): 300 mm
- exterior plaster (existing): 20 mm
- adhesive layer: 10 mm
- extruded polystyrene: 260 mm
- exterior plaster (new): 20 mm
- total: 630 mm

Basement ceiling $U$-value: 0.29 W/(m²·K)
(top down)
- anhydrite floor: 25 mm
- footstep sound insulation: 15 mm
- polyurethane: 60 mm
- brick floor (existing): 175 mm
- total: 275 mm

Cladding and insulation of the existing principal moulding
(source: GAG)
**Summary of U-values W/(m²·K)**

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
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</thead>
<tbody>
<tr>
<td>Attic floor</td>
<td>0.26</td>
<td>0.09</td>
</tr>
<tr>
<td>Walls</td>
<td>1.35</td>
<td>0.11</td>
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<tr>
<td>Basement ceiling</td>
<td>0.91</td>
<td>0.29</td>
</tr>
<tr>
<td>Windows</td>
<td></td>
<td>0.84*</td>
</tr>
</tbody>
</table>

* incl. installation thermal bridges

**ENERGY PERFORMANCE**

Heat energy demand (according to PHPP)
- Before: 233 kWh/m²a
- Afterwards (PHPP): 15 kWh/m²a
- Reduction: 94%

Primary energy demand (heating, hot water, auxiliary and household electricity according to PHPP)
- Before: 327 kWh/m²a
- After (PHPP): 29 kWh/m²a
- Reduction: 88%

**BUILDING SERVICES**

Each apartment has mechanical ventilation with heat recovery (efficiency >85%) and a towel radiator. The remaining heat energy demand is supplied by a gas-fired combined heat and power unit.

**RENEWABLE ENERGY USE**

The south oriented roof areas are used for PV in place since 2005 (141 solar modules with an annual output of approx. 19 000 kWh).

**INFORMATION SOURCES**

Passive House Institute, Darmstadt, DE  
[www.passiv.de](http://www.passiv.de)  
GAG Ludwigshafen am Rhein  
[www.gag-ludwigshafen.de](http://www.gag-ludwigshafen.de)  

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