5-Storey Apartment House in Linz - Makartstraße, A

PROJECT SUMMARY
After renovating the residential complex to a passive house, the apartments offer a much higher user comfort. This project includes the aspects of an effective concept of redevelopment in consideration of forward-looking methods.

SPECIAL FEATURES
Reduction of energy index from approx. 179 kWh/m² living space to 14.4 kWh/m² (by PHPP).

ARCHITECT
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OWNER
GIWOG - Gemeinnützige Industrie-Wohnungsaktiengesellschaft

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

The fabric of the building, which is almost five decades old, is in a good condition. The exterior walls, constructed out of poured concrete, have a U-value of approximately 1.4 W/m²K. An insulation was later applied to parts of the cellar ceiling.

AIMS

- Reduction of the heating costs to a minimum
- Optimised ventilation and building services concept
- Ecological renovation with renewable resources
- High degree of pre-fabrication
- Renovation without disturbance of residents

SUMMARY OF THE RENOVATION

- Insulation of facades, floors, roofs
- Triple glazing of windows including an anti-glare shield
- Decentral mechanical ventilation with heat recovery
- Highly insulated outside walls by using the “Gap-Solar Façade”
- Enlargement of floor space by closing the balconies
- Utilization of prefabricated wall units, which have the dimension of a flat width and floor height
The mechanical ventilation system

CONSTRUCTION

Floor construction  
U-value: 0.205 W/(m²·K)  
(top down)  
Insulation  100 mm  
Reinforced concrete  200 mm  
Floor  80 mm  
Wooden floor  20 mm  
Total  400 mm

Wall construction  
U-value: 0.158 W/(m²·K)  
(interior to exterior)  
(Static)  
Plaster  10 mm  
Poured concrete  300 mm  
Insulation  60 mm  
OSB airtight  16 mm  
Panel insulation  130 mm  
MDF  4 mm  
Solar comb  50 mm  
Air gap (slightly ventilated)  31 mm  
ESG float glass panel  6 mm  
Total  607 mm

Basement ceiling  
U-value: 0.093 W/(m²·K)  
(top down)  
Reinforced concrete  140 mm  
Poured concrete  100 mm  
Insulation  400 mm  
Total  640 mm
Summary of U-values W/(m²·K)

<table>
<thead>
<tr>
<th></th>
<th>Before</th>
<th>After</th>
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<tbody>
<tr>
<td>Attic floor</td>
<td>0.9</td>
<td>0.09</td>
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<tr>
<td>Walls</td>
<td>1.2</td>
<td>0.08</td>
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<tr>
<td>Basement ceiling</td>
<td>0.7</td>
<td>0.21</td>
</tr>
<tr>
<td>Windows</td>
<td>3.0</td>
<td>0.86</td>
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</tbody>
</table>

The Gap-Solar Façade system consists of a special cellulose comb, arranged behind a facade of glass panels. The solar radiation enters the solar comb and warms it up. A warm zone is created on the outside wall, which reduces the thermal losses.

The solar honey-comb acts as a solar absorber. The effectiveness of the gap-solar facade depends on the quantity of sunlight and on the cardinal point. On southern sides nearly lossless walls are possible, with average dynamic U-values of about 0.08 W/m²K.

ENERGY PERFORMANCE

Space heating energy demand
Before: approx. 179 kWh/m²a
After: 14.4 kWh/m²a (according to PHPP)
Reduction: 91 %

INFORMATION SOURCES


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BUILDING SERVICES

The building will meet the requirements of a passive house through a prefabricated ventilated Gap-Solar Façade, reinforced insulation of top floor and cellar ceiling, enlargement of existing balconies including parapet insulation, glazing with passive house windows including integrated sun protection, new roofing as well as controlled room ventilation with single room ventilators.

Expected savings of about 444.000 kWh/a will decrease carbon dioxide emissions from about 160.000 kg/year to 18.000 kg/year.

Before modernization: heating costs for a flat of 59 m²: € 40.80/month – after modernization: € 4.73/month.