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

SHC
SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Before

After

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.
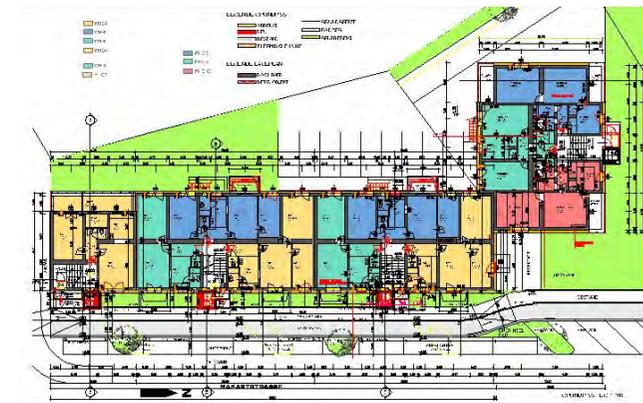
AIMS

- 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
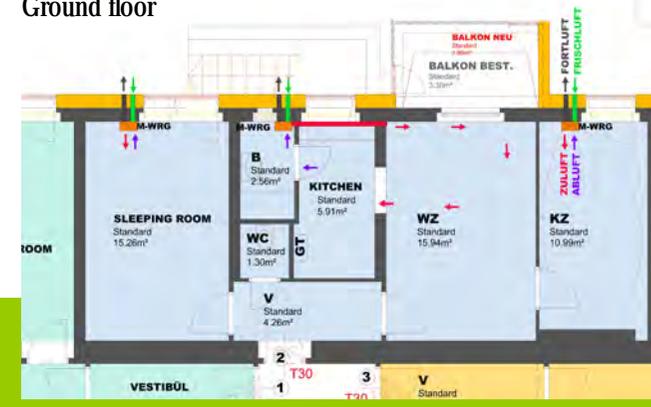
SUMMARY OF THE RENOVATION

- 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
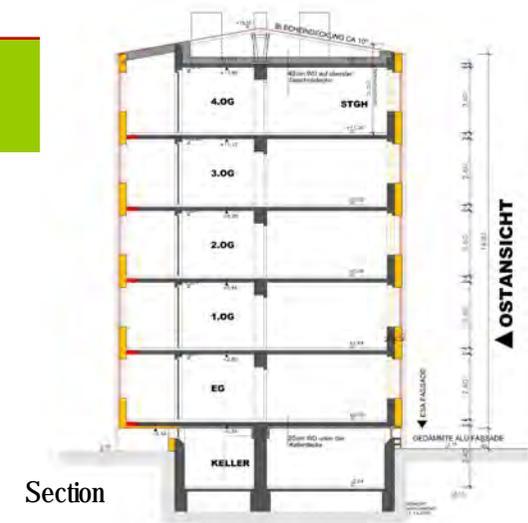
Section

Ground floor

Prefabricated and mounted wall units

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)	31mm
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
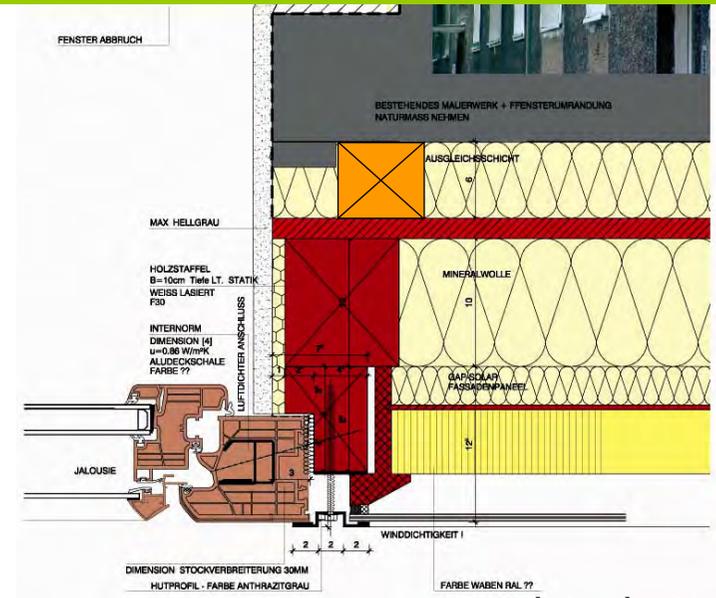
horizontal section
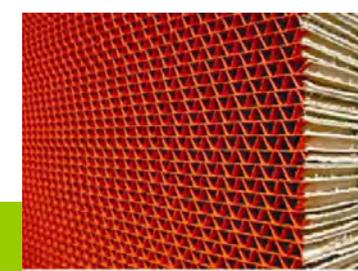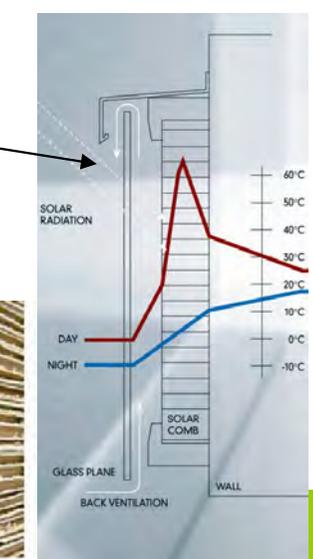
Gap-Solar Façade

Summary of U-values W/(m²·K)

	Before	After
Attic floor	0.9	0.09
Walls	1.2	0.08 [1]
Basement ceiling	0.7	0.21
Windows	3.0	0.86

[1] Dynamic U-value with solar input (Gap-Solar Façade)

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.

RENEWABLE ENERGY USE

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 quantum 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

Erstes Mehrfamilien-Passivhaus im Altbau, Berichte aus Energie und Umweltforschung 21/2007, bmvit.

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