Husby Terrasse, Stjørdal, Norway

PROJECT SUMMARY
Renovated 2004-2005
110 Apartments
The first larger low-energy housing renovation project in Norway

ARCHITECT
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Renovation: Grethe Mahlum, Arkideco

OWNER
Husby borettslag

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

Original facades from 1970

After renovation, 2005

The view from the living room, towards south and the fjord

BACKGROUND

• Terraced apartments, built in 1970 according to building codes from 1969. Orientated towards south.

• Important aim for the construction concept in 1970 was utilizing non-productive land/steep slopes at low construction costs. The project received both national and international attention during the seventies for this concept. The buildings are built on an old slate quarry, and are standing on pillars. The cavity between the floors and the ground comprises continuously closed crawl spaces (walls along the gable sides)

• Motivation for renovation:
    - High electricity consumption
    - Complaints about poor indoor climate
    - Inspired by the low energy project at Husby Amfi (built by the housing cooperative)
    - The capacity of the electric transformer was not sufficient to cover both the old (Husby Terrasse) and the new (Husby Amfi) buildings.

SUMMARY OF THE RENOVATION

• Added insulation (+15 cm) and new and better air tightening on the gable walls.
• Reduced thermal bridges on gable walls, and in the join floor/south wall (the grooves in the floor in front of windows and balcony doors, housing the old electric convector heaters, were filled with mineral wool).
• The south walls had been renovated earlier, with additional insulation (to a total of 150 mm) and new cladding. Therefore these walls were left unchanged at the new renovation.
• Balanced ventilation system (rotary wheel heat exchangers) in each flat. The efficiency of the heat exchanger is assumed to be approximately 80 %.
• New windows and balcony doors (triple glazing, U = 1,0 W/m^2K).
• No added insulation in floors and roofs due to too high costs related to moving people out and back and also large resistance among the occupants against the moving.
• Replacing the old electric convector heaters with modern electric room heaters with thermostats (solar collector assessed, but poor profitability).
• Due to new triple glazed window panes, the daylight transmission was reduced by approximately 10 %.

The old electric convector heaters in front of the balcony doors were removed, and the cavities insulated and sealed.

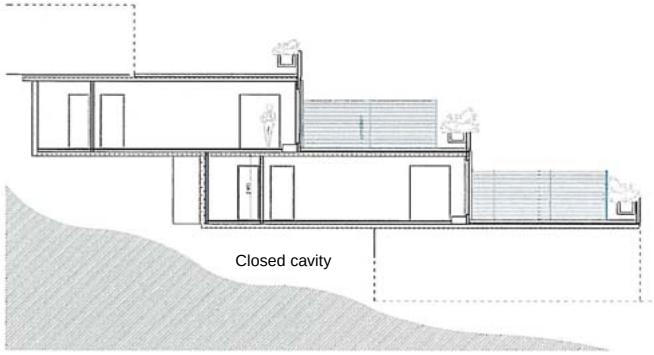
After removing the panels (and old insulation) on the gable walls, 2 layers of insulation were added.

CONSTRUCTION

Roof construction	*U-value: 0.48 W/(m²·K)*
Concrete (existing)	120 mm
Insulation (existing)	50 mm
Concrete (exisiting)	130 mm
Total	300 mm

Floor construction	*U-value: 0,94 W/(m²·K)*
Concrete (exisiting)	130 mm
Insulation (existing)	15 mm
Total	145 mm

Gable wall construction	*U-value: 0,18 W/(m²·K)*
Facade panels	20 mm
Asphalted cardboard	13 mm
Concrete	150 mm
Plaster Board	13 mm
Insluation (existing)	50 mm
Insulation (new)	150 mm
Total	396 mm



Section

Plan for a large and a small apartment (showing two of four departments on the ground floor)

The new ventilation ducts were left uncovered in the living rooms. This occured large displeasure among the occupants

The occupants had to cover the ducts themselves, for instance in a kitchen showed on the picture

Summary of U-values W/(m²·K)

Construction	Before	After
Roof	0.48	0.48
Floor	0.94*	0.94
Outside wall south	0.35**	0.35
Gable walls	0.64	0.18
Outside wall north (only top floor)	0.76	0.76
Windows	2.5	1.0
Balcony door	3.0	1.0

*In order to utilize the heat in the exhaust ventilation air, the exhaust outlets (no heat recovery) were before the renovation placed towards the closed crawl spaces beneath the buildings/floors. The partly heated crawl spaces reduced the thermal losses through the floors. After renovation the losses through the floors are higher. This is due to the new balanced ventilation systems with heat recovery, i.e. there is not longer any warm exhaust air coming out to the crawl spaces.
**The south walls had earlier been renovated with 5 cm additional insulation to a total of 15 cm

BUILDING SERVICES

Electric resistance heating (panel heaters)

Electric water heating

Balanced ventilation with rotary wheel heat exchanger

ENERGY PERFORMANCE

Total measured energy use (delivered/primary energy):

Before: 265/623* kWh/m²
After: 150/353 kWh/m²
Reduction: 43 %
* Primary energy factor for electricity: 2.35

Calculated energy use for space + water heating (delivered/primary energy)

Before: 205/482 kWh/m²
After: 90/212 kWh/m²
Reduction: 56 %

INFORMATION SOURCES

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