PROJECT SUMMARY
Between 1963 – 1973 about one million apartments were built in Sweden, “the million-programme”. Now 30-40 years later, they are in great need of renovation. In Alingsås, 300 of these apartments will be renovated to passive house standard.

SPECIAL FEATURES
Balconies moved to hang outside facades to decrease thermal bridges

ARCHITECT
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OWNER
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IEA SHC Task 37
Advanced Housing Renovation with Solar & Conservation

Apartment Building in Brogården, Alingsås SE
BACKGROUND
The Brogården housing estate with 300 apartments built 1970 is in great need of renovation. The tenants complain about draughts and cold apartments and the facade exterior has mouldered away. The apartments are not suitable for elderly or disabled persons. Renovation is needed in any case and energy aspects are to be included. Initially, one building with 18 apartments will be renovated and serve as a demonstration project. Renovations following this demonstration phase will profit from the experience gained. The project will be monitored after completion of the renovation.

RENOVATION MEASURES
• Added insulation (ground floor, exterior walls and roof)
• New facade material
• New windows
• Increased air-tightness of the building envelope
• New balconies relocated to outside the facade
• New build entrance vestibules
• New ventilation system with heat exchanger
• New energy-efficient household appliances
• Solar collectors for domestic hot water
**IMPROVED CONSTRUCTION**

**Floor construction**  \( U\text{-value: } 0.26 \text{ W/(m}^2\text{K)} \)
- (interior to exterior)
- Particle board \(22 \text{ mm}\)
- Expanded polystyrene EPS \(110 \text{ mm}\)
- Moisture barrier \(5 \text{ mm}\)
- Concrete (existing) \(180 \text{ mm}\)
- Plastic foil (existing)
- Gravel (existing) \(150 \text{ mm}\)
- Total \(467 \text{ mm}\)

**Wall construction**  \( U\text{-value: } 0.12 \text{ W/(m}^2\text{K)} \)
- (interior to exterior)
- Interior plaster (existing) \(13 \text{ mm}\)
- Wooden beams + mineral wool (existing) \(100 \text{ mm}\)
- Insulation board \(80 \text{ mm}\)
- Steel beams + mineral wool \(195 \text{ mm}\)
- Steel beams + mineral wool \(45 \text{ mm}\)
- Insulation board \(50 \text{ mm}\)
- Exterior facade material (not yet decided)
- Total \(483 \text{ mm}\)

**Top floor ceiling/Attic floor**  \( U\text{-value: } 0.10 \text{ W/(m}^2\text{K)} \)
- (top down)
- Concrete (existing) \(160 \text{ mm}\)
- Mineral wool (existing) \(150 + 30 \text{ mm}\)
- Loose wool insulation \(200 \text{ mm}\)
- Total \(540 \text{ mm}\)
Overview 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>0.21</td>
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<td>Walls</td>
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<td>Ground construction</td>
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<tr>
<td>Windows *</td>
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*Including frame

**BUILDING SERVICES**

Each apartment has its own air-to-air heat exchanger with 85% heat recovery efficiency. Heat is delivered to the apartments by the air system with an air to air heat exchanger. Heat for space heating and domestic hot water is supplied by solar collectors and district heating.

**RENEWABLE ENERGY USE**

No final decision taken regarding solar thermal system.

**ENERGY PERFORMANCE**

Space + water heating
Before: 145 kWh/m²a
After: 55 kWh/m²a
Reduction: 62%

**INFORMATION SOURCES**

Janson, U., February 2008, Passive Houses in Sweden, Lund University (English)
http://www.ebd.lth.se/forskning/passivhus_demonstrationsprojekt/

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