Experiences from Apartment Buildings as Passive Houses in Sweden

Frillesås
Lidköping
Värnamo
Alingsås

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Lindås – first passive houses in Sweden
Glumslöv, Landskrona
Main purpose

• See what knowledge, components and systems that are needed to achieve buildings with a very low energy demand

• Monitoring and evaluation of demonstrations projects
New passive house projects in Sweden

- Alingsås
- Frillesås
- Lidköping
- Värnamo
Oxtorget, Värnamo

- Finnvedsbostäder
- 40 rental apartments in 2 or 2,5 storeys
- 2 – 5 rooms
Ground construction
Load bearing structure

- Concrete – cast at site
Outer walls

• Wooden walls – made on site
Roof construction
U - values

Outer wall: 0.10 W/m²,K
Roof: 0.07 W/m²,K
Floor facing ground: 0.10 W/m²,K
Windows: 0.94 W/m²,K
U - values

Outer door: 0.6 W/m²,K
December 2005
Inauguration September 2006
• Solar system for domestic hot water
• Air-to-air heat exchanger
• Additional heat and domestic hot water by electric heating
Air tightness

Measured mean value:
0.2 l/s,m² at 50 Pa
Moisture awareness
Sounds

Bedrooms: 19, 19, 23 and 23 dB(A)
Kitchen: 27 dB(A)
Bathrooms: 31 and 35 dB(A)
Hallway: 35 dB(A)
• Peak load for space heating 12 W/m²
• 80 kWh/m², a total energy use at indoor temperature of 20°C
• 67 kWh/m², a delivered energy (bought energy) at indoor temperature of 20°C
Bought energy (kWh/m²)

Energiförbrukning per m² (2006/2007)

Källa: Finnvedsbostäder
Measured bought energy

- 67 kWh/m²,a bought energy (domestic hot water, heating, household electricity and electricity common area) at 20°C, Oxtorget
- 144 kWh /m²,a, Apollofjärilen
- 180 kWh /m²,a average
Still remains...

- Evaluate measurements
- Interviews with tenants
Frillesås

• Eksta Bostads AB
• 12 rental apartments, two storeys
- Solar system for domestic hot water
- Air-to-air heat exchanger
- Additional heat by district heating
- Heating coil in bathrooms
Ground construction
Load bearing construction

- Steel
- Filigree system of beams
Outer walls

• Wooden prefabricated walls insulated on site
Roof construction
U-values

Outer wall: 0.10 W/m$^2$K (440 mm insulation)
Roof: 0.08 W/m$^2$K (500 mm insulation)
Floor facing ground: 0.10 W/m$^2$K
Windows: 0.85 W/m$^2$K
Outer door: 1.0 W/m$^2$K
Air tightness

0.2 l/s, m² at 50 Pa
(Required; 0.25 l/s, m² at 50 Pa)
• Calculated peak load for space heating: 10 W/m²
• Space heating: 16 kWh/m²,a at indoor temperature of 22°C
Still remains…

- Evaluation of measurements
- Interviews with tenants
Villa Malmborg, Lidköping

- Vårgårdahus
- One family house
- 170 m² in two floors
Construction

• Wood – load bearing construction
• Wood – outer walls
Assemblage
U - values

Outer wall: 0.10 W/m²,K
Roof: 0.08 W/m²,K
Floor facing ground: 0.09 W/m²,K
Windows: 0.85 W/m²,K
Outer door: 1.2 W/m²,K
Air tightness

40 blocks in this house – 8 blocks normally
Air tightness

Demand:
0.2 l/s,m² at 50 Pa
Rain....
- Air-to-air heat exchanger
- Additional heat by district heating
• Estimated space heating demand: 20 kWh/m², a at indoor temperature of 20°C
• Peak load for space heating 12 W/m²
• Measurements
• Interviews
Brogården, Alingsås

- Alingsåshem
- 18 rental apartments, 3 storeys
- 2 – 3 rooms
Existing ventilation
• Air tightness
• Moisture accumulation
Brogården, Alingsås
Measures to take

- Insulation on the ground floor and the walls
- New façade material
- New windows
- Move balconies
- Entrance
- New ventilation with heat exchanger
- New energy-saving white goods
- Solar panels for domestic hot water
## Energy Demand

### Brogården, Alingsås

<table>
<thead>
<tr>
<th>Energy Demand (kWh/m²a)</th>
<th>Today (2004)</th>
<th>Goal: Demonstration building</th>
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</thead>
<tbody>
<tr>
<td>Space Heating</td>
<td>115</td>
<td>30</td>
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<tr>
<td>DHW</td>
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<td>25</td>
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<tr>
<td>Household Electricity</td>
<td>39</td>
<td>27</td>
</tr>
<tr>
<td>Electricity, common area</td>
<td>20</td>
<td>13</td>
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<tr>
<td>Sum</td>
<td>204</td>
<td>95</td>
</tr>
</tbody>
</table>

District heating; supply air heating
DHW; district heating (+ solar collectors in other houses)
Brogården, Alingsås: Renovation of apartment buildings


Delivered Energy (kWh/m²a)

- Electricity, common areas: 20
- Household Electricity: 39
- Domestic Hot Water: 30
- Space heating: 115

Renovated:
- Electricity, common areas: 13
- Household Electricity: 27
- Domestic Hot Water: 25
- Space heating: 30