Husby terrasse

Renovated terrace

houses in Norway

by

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and with contributions from

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SINTEF Building and Infrastructure

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Husby Terrasse

- Built in 1970
- Built in accordance with building regulations from 1969
- Orientated towards south, fantastic view over Stjørdal and the fjord, terraces up to 90 m^2
- Focus on utilizing non-productive land/steep slopes (built on old slate quarry)

Original facades from 1970

- Low-cost housing (aim: individual loans from the Norwegian State Housing Bank for young people)
- Simplified structure (the only connection between the buildings and the ground are the pillars) gave same building costs (or lower) compared to row houses built on flat land
- The low-cost and ”resource effective” concept received both national and international attention during the seventies

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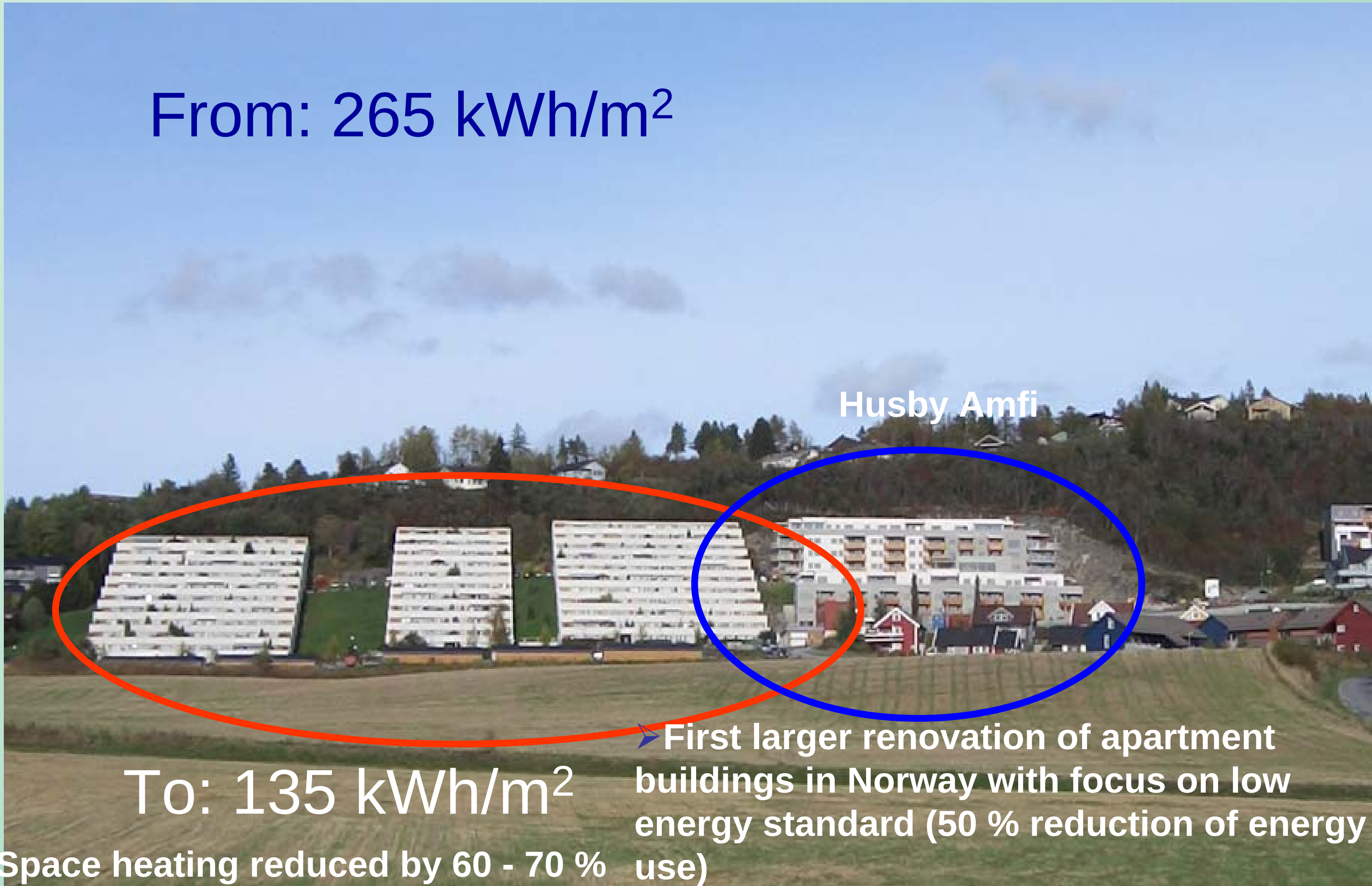
Husby Terrasse, Stjørdal.



From: 265 kWh/m²

To: 135 kWh/m²

Space heating reduced by 60 - 70 %

- First larger renovation of apartment buildings in Norway with focus on low energy standard (50 % reduction of energy use)

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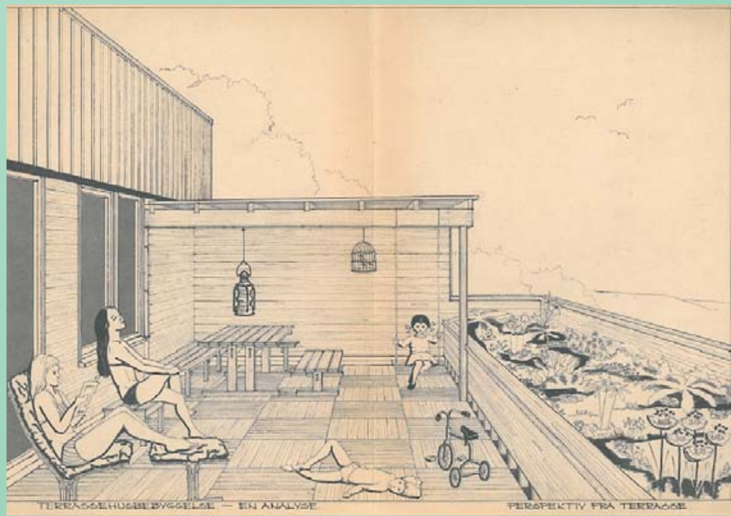
Renovation of 110 apartments

- **Renovated 2004 - 2005**
- **Motivation for renovation**
  - **High electricity consumption**
  - **Complains about indoor climate**
  - **Inspired from the low energy project at Husby Amfi**
  - **The transformer (electricity) capacity was not sufficient to cover both old (Husby Terrasse) and new (Husby Amfi) buildings**
- **Decision about renovation (energy saving measures) made by the housing cooperative board. Decision process: no information (at the moment)**
  - **Profitability important aspect (SINTEF analysis showed poor profitability)**
  - **Some resistance among the occupants/owners**
  - **Enthusiastic board leader**
  - **Funding from Enova**



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High energy consumption caused by…

- **Exhaust ventilation with no heat-recovery (but outlet via culvert under the floors gives reduced heat transmission)**
- **Windows with high U-value**
- **External walls with high U-value**
- **Thermal bridges**
- **Air leakages**
- **Defective (lack of setback) in temperature control**

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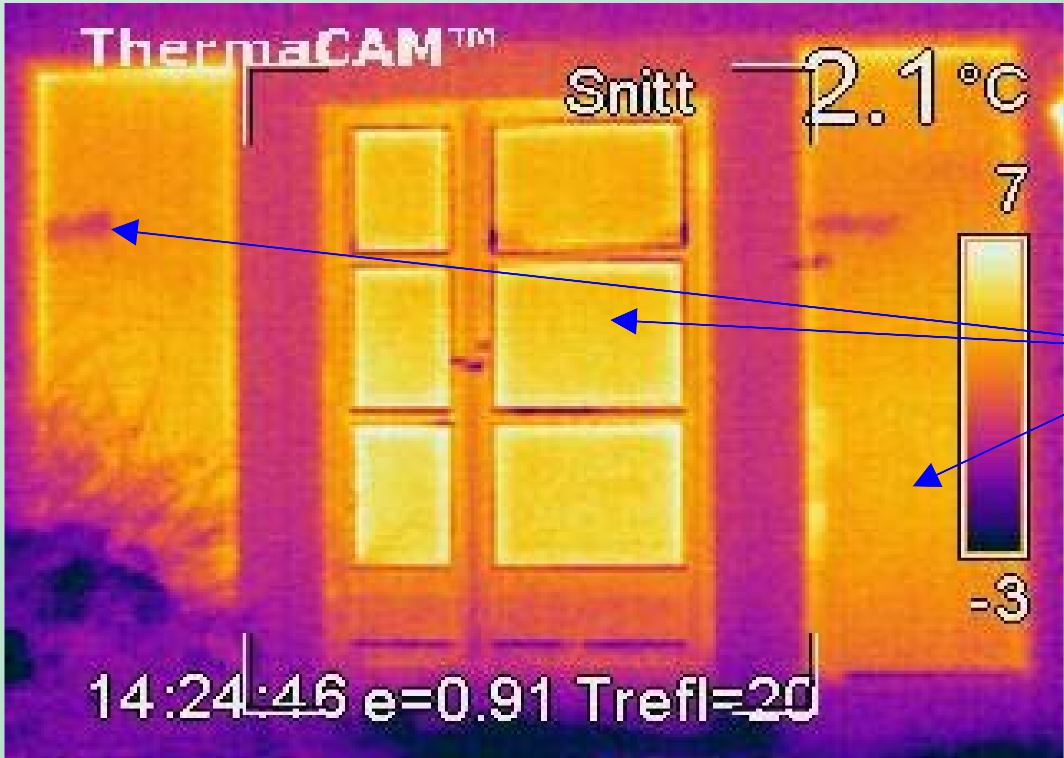
Cause and effect…..



High U-value in windows and balcony door, result in heat leakages from the inside.

(photo is taken from outside)

New windows and balcony doors

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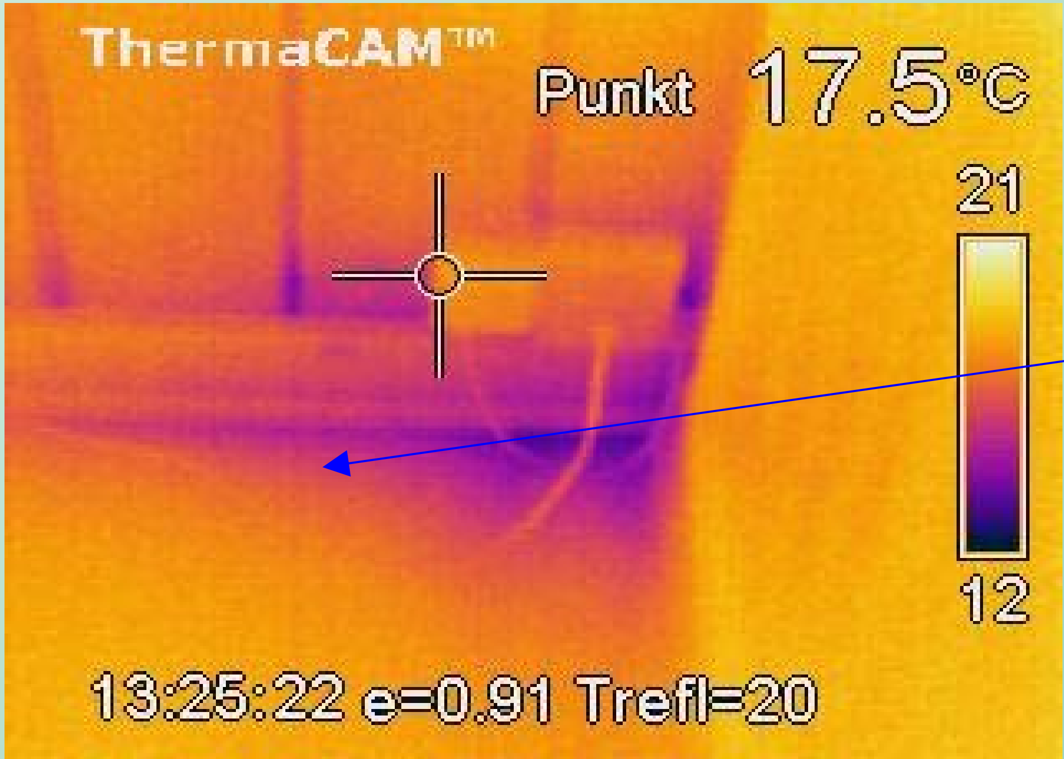
Cause and effect…..



Thermal bridge in the joint between external walls and the floor (concrete slab)

(photo is taken from inside)

Reduces thermal bridges in front of the front wall

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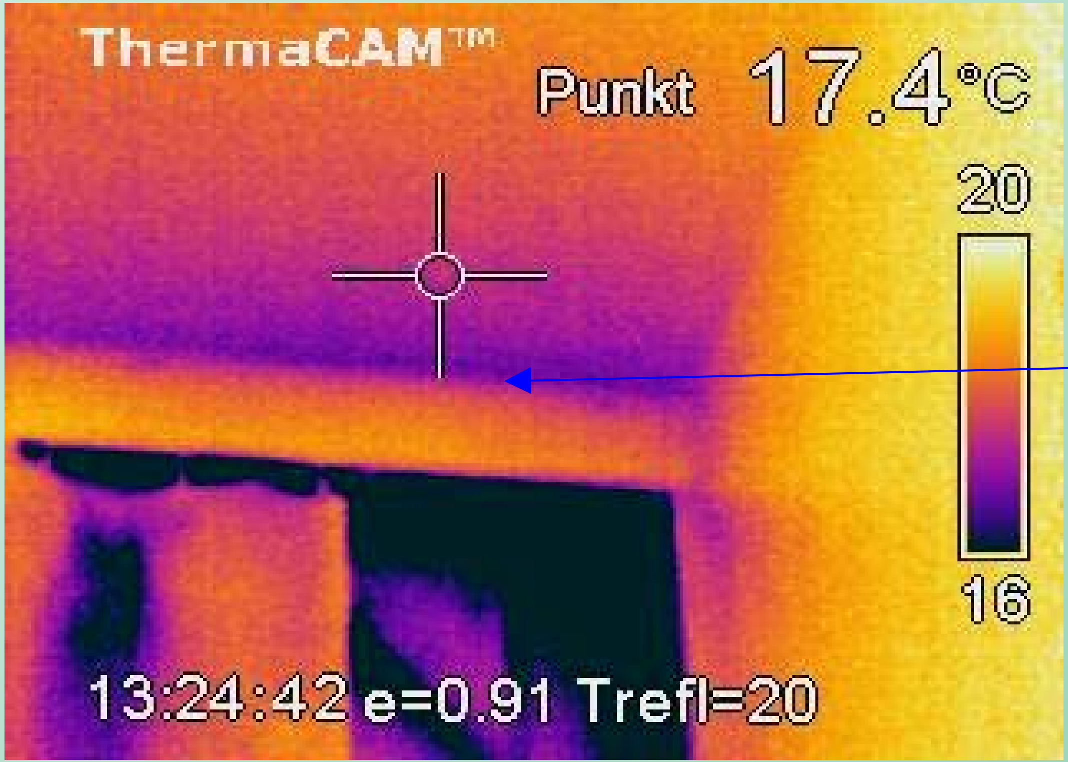
Cause and effect…..



Thermal bridge in the joint between external walls and the roof (concrete slab)

(photo is taken from inside)

No measures carried through, but silicon filling where obvious air leakages

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Chosen measures for 108 flats (main renovation project)

- **Based on actual costs for the first two flats:**
  - Added insulation on gable walls (+ 15 cm)
  - Balanced ventilation (rotary wheel heat exchangers)
  - New windows and balcony doors (triple glazing, U = 1,0 W/m^{2}K)
  - **No** added insulation in floors and roofs
    - too high costs related to moving people out and back –and also large resistance among the occupants against the moving
  - New and modern electric room heaters with thermostats (solar collector assessed, but poor profitability)

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Insulation in walls, roofs and floors (main renovation project)

Old construction	U-value [W/m²K]	New construction	New U-value [W/m²K]
Roof (balcony-floor): 120 mm concrete, 50 mm insulation, 130 mm concrete	**0,48**	**No action**	**0,48**
Floor (towards partly heated culvert for exhaust ventilation air): 130 mm concrete + 15 mm insulation	**0,94**	**No action (larger thermal losses due to colder culvert!)**	**0,94**
Outside wall - south: 100 mm + 50 mm insulation	**0,35**	**No action (but reduced thermal bridges along the floor/wall joint)**	**0,35**
Gable walls: Steel panels, asphalted cardboard, concrete and plaster board, 50 mm insulation	**0,64**	**+ 150 mm insulation and new and better air tightening**	**0,18**
Outside wall north (only top floor): Concrete and 100 mm wood wool slab	**0,76**	**No action**	**0,76**
Windows (1+1 layer)	**2,5**	**3 layers (two low-e-coatings, argon gas filling)**	**1,0**
Balcony door (1+1 layer)	**3,0**	**3 layers (two low-e-coatings, argon gas filling)**	**1,0**

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Outside wall before adding insulation.

Old steel panels. The panels are removed

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After removing the panels (and old insulation), 2 layers of insulation is added.

(Second layer)

Outside wall finished

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Energy efficient windows with triple glazing, 2 low emission coatings, argon gas, superspacers and wooden frame. Gives U-value of 1,0 W/m²K.

4E – 12Ar – 4 – 12 Ar - E4

- 4 mm glas with low emission coating
- 12 mm argon filled space
- 4 mm glas
- 12 mm argon filled space
- 4 mm glas with low emission coating

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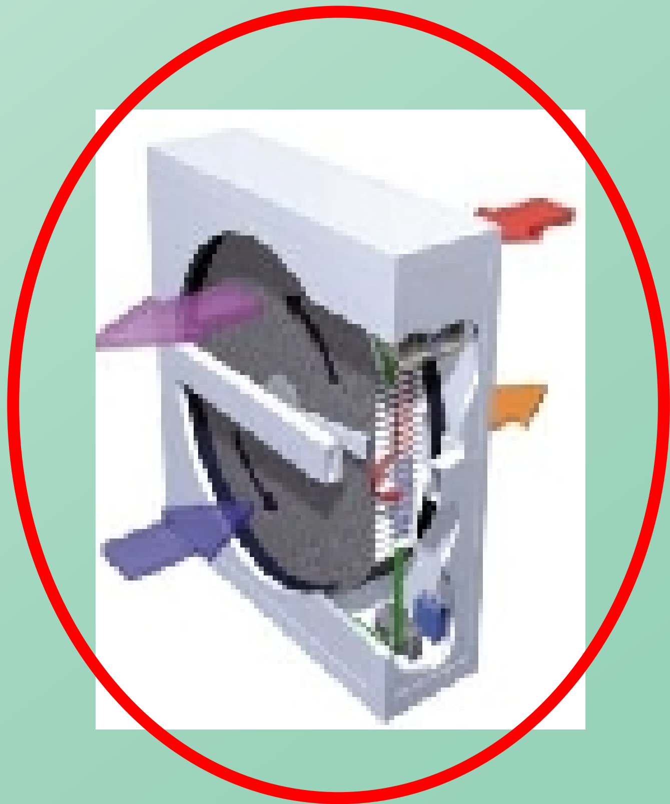
Balanced ventilation system with heat recovery



Energy budget (Net energy demand)

Description	**Calculated** Energy demand **before** measures	**Calculated** Energy demand **after** renovation	**Measured** energy consumption **after** renovation
Heating	171 kWh/m²	50 kWh/m²	
Heating ventilation coil	0 kWh/m²	6 kWh/m²	
Hot water	33 kWh/m²	33 kWh/m²	
Fans and pumps	4 kWh/m²	4 kWh/m²	
Lighting	24 kWh/m²	24 kWh/m²	
Equipment	24 kWh/m²	24 kWh/m²	
Total	256 kWh/m² (measured 264)	141 kWh/m²	132 kWh/m² (two flats)*

***Preliminary results show about 10% higher energy use for the other flats**

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