



El-Education  
Best practice example No. 1 from Denmark



## Oesterbro (Denmark)

**51 % heating saving**

**Among the most important solar low energy retrofit projects in the housing sector in Denmark**

**First innovative solar wall construction in Denmark**

### Project data

Location, address:	Østerbro
Region:	Copenhagen
Surroundings:	City
Climate:	mild
Heating degree days:	2906
Year of construction and renovation:	1925 (constructed); 1994-1995 (renovated)
Typology:	Apartments in 5 floor residential building block
No of dwellings:	76 apartments,
Total floor area:	9.896 m <sup>2</sup>
Owner:	Danish Housing Association, AAB
Architect and Builder:	Klaus Boyer Rasmussen, SolarVent; AAB
Costs of energy saving measures:	1,78 mio. Euro
Renovation financed by:	EU Thermie Programme, Danish Energy Authority



Pic 1: Solar wall and solar heating system for DHW.

### Objectives and Results

The Oesterbro project managed to achieve some good results. The main aim to reduce the district heating consumption and to establish low temperature district heating, was succeeded. The indoor air climate got improved as well. Another very important aim which was accomplished, was to present super low energy windows. The project was able to show after the renovation, the possibility of making large energy saving houses with less maintenance costs.

### Renovation concept

#### Key renovation features

- Solar wall
- Individual sun spaces/patios and glazed balconies
- Super low-energy windows
- Solar heating system for DHW
- Insulation of walls and attic, 200 mm Rockwool facade insulation in the courtyard, improved insulation against attic with 300 mm mineral wool
- Ventilation systems with counter flow heat recovery in all apartments

### State-of-the-art

#### Before renovation

##### Constructions

- Windows with u-value of 4,05
- Total heating consumption: 125 kWh/m<sup>2</sup>

##### Installations

No mechanical ventilation

#### After renovation

##### Constructions

- Low-energy windows with u-value of 1,24
- Total heating consumption: 61 kWh/m<sup>2</sup>

##### Installations

- heat recovery ventilation system

### Energy saving and monitoring

Energy consumption before renovation:  
KWh/m<sup>2</sup>: 61

Energy consumption after renovation:  
KWh/m<sup>2</sup>: 125  
Percentage saving: 51 %

The above-mentioned energy consumption is the monitored result after renovation.

### Additional information

#### HRV:

- Counter flow heat exchanger, high efficiency of 80 %
- Heat recovery unit and ducts hidden in the false ceiling in hall
- Exhaust fan located in the attic
  - avoid obnoxious smells
  - reduce sound level
- Electricity use of approx. 100 W per apartment

#### Solar wall:

- 178 m<sup>2</sup> "solar wall" construction with *Okalux* transparent insulation
- Pre-heating of ventilation air
- Reduction of heat consumption
- Annual contribution from solar wall to building ventilation: 105 kWh/m<sup>2</sup>
- Total annual output from solar wall: 18.690 kWh

#### Other technologies:

- Individual sun spaces/patios and glazed balconies
- Use of super low-energy windows from *Rationel Windows*
  - U-value of triple-layer glazing 0,7 W/m<sup>2</sup>K
- Solar heating for DHW with 238 m<sup>2</sup> roof integrated solar collectors facing west, east and south
- Intelligent energy monitoring system with CTS
- Centrally placed low temperature radiators in apartments as basis for low temperature district heating

### Lessons learned and conclusions

- Among the most important solar low energy retrofit projects in the housing sector in Denmark

### References

"Solenergi og Byøkologi", by Peder Vejsig Pedersen, 1<sup>st</sup> edition 2002