



**Gärdsten,
(Sweden)**

Energy savings: 44 %
Sustainable/bio climatic design
Integration of renewable energy

Project data

Location, address:	Gärdsten, Göteborg, Sweden
Region:	Göteborg
Surroundings:	Rocky landscape in the suburb Angered, north-west of Göteborg
Climate:	Continental and cold
Heating degree days:	2906
Year of construction and renovation:	Beginning of 1970'ies (construction); 2000 (renovated)
Typology:	Apartment building
No of dwellings:	255 apartments in 10 buildings
Total floor area:	19.000 m ² (heated floor area)
Owner:	Gårdstensbostäder, Kastanjgården 3, 424 39 Angered, Sweden gbg@gardstensbostader.goteborg.se
Architect and Builder	CNA – Christer Nordström Arkitektkontor AB; Gärdstenbostäder
Costs of energy saving measures:	Building costs: 10,7 Meuro
Renovation financed by:	Gärdstenbostäder subsidized by the EU



Objectives and Results

In the housing area of Gärdsten, the public housing company Gärdstensbostäder has renovated the residential buildings with a focus on energy efficiency, the integration of renewable energy, sustainable/bioclimate design and improved quality of life. The renovation was planned and performed in close co-operation with the tenants.

Fig.1: Gärdsten, Gothenburg, Sweden

Renovation concept

Key renovation features

- Solar air-heated double envelope external walls.
- Windows with low-E glass or with new timber-framed low-E windows.
- New roofing and extra roof insulation.
- Solar pre-heating of domestic hot water
- Solar pre-heating of fresh air through glazed balconies.
- Community greenhouse
- Composting and recycling
- Extra insulation of walls exposed to wind
- Space heating, DHW and water monitored for each apartment
- Heat recovery of ventilation air

State-of-the-art

Before renovation

After renovation

Installations

- Solar collectors for pre-heating of domestic hot water
- Storage tank for solar heated water

Energy saving and monitoring

Total energy consumption before renovation, incl. heating, DHW, house holding (lighting/cooking), common electricity:

KWh/m²: 275 kWh/m²

Total energy consumption before renovation, incl. heating, DHW, house holding (lighting/cooking), common electricity:

KWh/m²: 165 kWh/m²

Percentage saving¹: 44%

After the renovation, the energy consumption has been monitored. The above-mentioned consumption is monitored.

Additional information

- The renovation was planned and performed in close co-operation with the tenants.
- Space heating, DHW and water are monitored for each apartment.
- The three 7-storey balcony-access buildings have received new pitched roofs. Prefabricated roof modules of flat plate solar collectors have been installed on the south facing part of the new roofs. The modules function constructional as both solar collector and roof. The solar collectors pre-heat DHW for all apartments on the estate.
- An innovative air heated solar system has been applied to a 3-storey building. solar collectors are mounted on the south-facing wall. External insulation has been added to north, east and west, leaving an open space to the original facade where heated air from the solar collectors is transported. Heat is stored in the thermal mass of the original concrete facade elements. The joints between elements, which before renovation resulted in large heat losses, now allow the warm air into the apartments. When the cooler air reaches the bottom of the wall cavity it is returned to the solar collector to be re-heated. The system is closed and separate from the ventilation system. The solar air collector system used for the building is "The Friendly Wall", manufactured by ABB.

Lessons learned and conclusions

The project is considered as one of the most ambitious and successful renovation projects in Gothenburg.

References

www.cna.se

www.gardstensprojektet.goteborg.se

¹ Compared to the situation before renovation