Housing cooperative Hagalund, Malmö (Sweden)

Country: **Sweden**

Name of city/municipality: **Malmö**

Title of case study: Housing cooperative Hagalund

Year and duration of the renovation: 2017–18

Author name(s): Erik Johansson, Henrik Davidsson
Author email(s): erik.johansson@hdm.lth.se, henrik.davidsson@ebd.lth.se

Link(s) to further project related information / publications, etc.:

Schematic figure or aerial overview

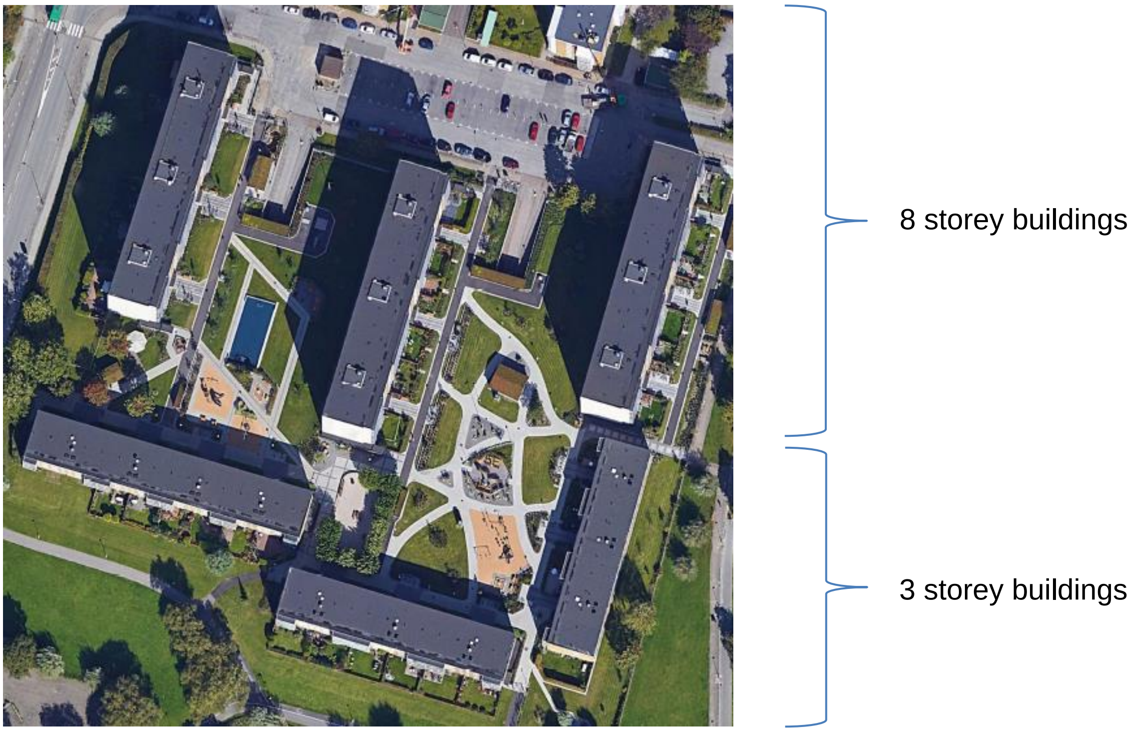

Figure 1. Aerial overview of Hagalund housing cooperative in Malmö, Sweden.

Table 1. Basic information.

No. of buildings	6
No. of dwellings	276 apartments and 2 premises
No. of levels	8 (3 buildings) and 3 (3 buildings)
Years of construction	1967
Total heated floor area	23,307 m^2
Population in the area	Ca. 550
Owned by	Bostadsrättsföreningen Hagalund (housing cooperative)
Usage	Residential

Figure 2. A 3 storey building in Hagalund housing cooperative.

Introduction and description of the situation before the renovation

The housing cooperative Hagalund is situated in the suburb Söderkulla in the south of Malmö, Sweden. The buildings are typical for the period 1965–1975 when 1 million housing units were built in Sweden, most of them as multi-family houses. Apartment buildings during this period were typically 3 and 8 floors as in the case of Hagalund.

Before the actual renovation, where the energy supply system was changed from district heating to ground source heat pumps and solar PV panels were installed, the buildings had gone through several renovations to improve their energy performance. In 1983, the regulating equipment of the heating stations as well as some windows were replaced. In 1986, additional insulation was added to the roofs and, in 1989, an additional window pane was added to the existing windows to achieve triple glazing. During 1999–2000, the balconies were extended and equipped with glazing, see Fig. 2. All district heating sub-stations were changed in 2011 and the elevators (in the 8 storey buildings) were replaced in 2017.

The exact U-values of walls, roofs and windows are not known. However, using statistics from the most common construction types of the construction period allows doing the following approximations for the U-Values:

- Walls: 0,4 W/(m²K)
- Roofs, where additional insulation was added: lower than 0,2 W/(m²K)
- Triple glazed windows: 1,9 W/(m²K).

These approximations are based on information found in the following report: "Teknisk status i den svenska bebyggelsen – resultat från projektet BETSI, Boverket 2010"[1].

There is no existing renewable energy generation on-site; solar energy is considered as a possibility to produce renewable on-site.

[1] https://www.boverket.se/globalassets/publikationer/dokument/2011/betst-teknisk-status.pdf

Description of the renovation goal

The overall aim of the project was:

1) to replace district heating with geothermal heat pumps in order to reduce energy use and to reduce the costs for the housing cooperative and

2) to increase the share of renewable energy by installing PV panels.

However, the buildings are still connected to the existing municipal district heating grid to receive additional energy during extremely cold periods (below -10°C). It is estimated that 90 % of the supplied energy comes from the heat pumps. The remaining 10 % comes from district heating. The geothermal heat pumps were installed in four substations, connected to 48 boreholes of 330 m depth. The heat pump installation was funded by the private company Skånska Energilösningar who will be the owner of the energy production during the first 10 years. After this period the ownership will be taken over by the housing cooperative.

The drivers for the district renovation were mainly to improve the economy of the housing cooperative but also to become more environmentally friendly. It was believed that this would make it more attractive to live in the district.

Description of the renovation concept

Since some envelope renovation had already taken place as described above (windows and roofs), the renovation focused on the heating and energy supply system by first replacing the existing district heating as the main heating system source, which had become expensive, with ground-source heat pumps, and then by installing solar PV panels on the flat roofs. The change of heating system also included a change of radiators in the apartments. This was very important since the new radiators were more efficient and enabled a lower temperature of the brine.

The 6,210 m² solar PV panels installation is estimated to produce annually 587,000 kWh of electricity. The PV system was financed by the housing cooperative. No financial risk was identified with purchasing the system.

The housing cooperative states that it was the company Skånska Energilösningar that took the initiative to installing heat pumps in order to replace the district heating. The goal with the installation was to supply 90 % of the annual heating need using the heat pumps. The housing cooperative also states that the entire design process for the heat pump project was solved without any problems.

Project Fact Box (I)

General information

Parameter	unit	before renovation	after renovation
Urban scale of area:	m²		
Population in the area:	-	ca. 550	ca. 550
Number of buildings in the area	-	6	6
Heated floor area of all buildings	m²	23,307	23,307
Building mix in the area:			
Single family homes (SFH)	% of heated floor area of all buildings	0	0
Multi-family homes (MFH) - up to three stories and / or 8 flats		0	0
Apartment blocks (AB) - more than 8 flats		100	100
Schools		0	0
Office buildings		0	0
Production hall, industrial building		0	0
other (please specify)		0	0
Consumer mix in the area:			
Small consumers: SFH + MFH – < 80 MWh/a	in % of annual heat demand	0	0
Medium consumers: AB, schools, etc. – 80-800 MWh/a		100	100
Large consumers: industrial consumers, hospitals, etc. > 800 MWh/a		0	0
Property situation of buildings:			
private	% of heated floor area	100	100
public		0	0
Property situation of energy supply system (district heating):			
private	% of heated floor area	100	100
public*		0	0

* Public district heating exists as backup.

Project Fact Box (II)

Specific information on energy demand and supply:

Parameter	**unit**	**before renovation**	**after renovation**
heating demand (calculated)	kWh/m²a	n/a - not available	n/a
domestic hot water demand (calculated)	kWh/m²a	n/a	n/a
cooling demand (calculated)	kWh/m²a	0	0
electricity demand (calculated)	kWh/m²a	n/a	n/a
heating consumption (measured)	kWh/m²a	n/a	n/a
domestic hot water consumption (calculated)	kWh/m²a	included in the heating consumption	n/a
cooling consumption (measured)	kWh/m²a	0	0
electricity consumption (measured)	kWh/m²a	n/a	n/a
(Thermal) energy supply technologies:			
decentralized oil or gas boilers	% of heated floor area	0	0
decentralized biomass boilers		0	0
decentralized heat pumps		0	100
centralized (district heating)		100	0*
other *(please specify)*			
renewable energy generation on-site:			
solar thermal collector area	m²	0	0
photovoltaics	kWp	0	6 210 m²
other (please specify)	kW		

* Public district heating exists as backup.

Financial issues:

Parameter	unit	before renovation	after renovation
total investment costs of the renovation	Euro/m^2	-	
- building envelope renovation costs	Euro/m^2	-	n/a
- heating/cooling supply costs	Euro/m^2	-	n/a
- renewable energy production costs	Euro/m^2	-	n/a
LCC available	yes / no		no

Description of the technical highlight(s) and innovative approach(es)

The innovative approach was to change from the original district heating system to ground-source heat pumps. The approach included an active role by an energy service company (ESCO) which analyzed the housing cooperative and designed an energy efficient solution. The same company installed the heat pumps and will be operating the system for 10 years. Energy will be sold to the housing cooperative. This covers the payback period of the investment plus a profit for the company.

The PV system was financed by the housing cooperative.

Decision and design process

General / organizational issues:
The main reason why the project was initiated, the main driver, was the ambition of the housing cooperative to reduce operational costs.

Stakeholders involved
The stakeholders involved were the housing cooperative and the energy service company. The latter also promoted the project.

Main steps
The company Skånska Energilösningar contacted the housing cooperative. They planned and executed the installation.

Main challenges regarding decision finding
No challenges were reported for the project.

Decision-making issues:

Main stakeholder	Level of influence (1 min- 5 max)	Type of influence (decision maker, influencer, technical advisor, delivery)	Driver/motivation
Policy actors (municipality department, government body, innovation agency, etc.)	1		
Users/ investors (individual owner, housing association, building managers, asset manager, project developer)	5	decision maker	reducing operational costs
District-related actors (Community/occupants organizations, etc.)	1		
Energy network solution suppliers (Distributor system operator, energy supply company, energy agency, ESCO, renewable energy companies)	5	influencer, technical advisor, delivery	profit
Renovation solution suppliers (Planning and construction parties, urban planners, architects, design team general contractors, products suppliers, ESCO, contractor, energy monitoring, facility manager, installation provider, one-stop-shop, etc.)	1		
Other intermediaries (public bodies, trade organizations, NGO's, consultancies, research institutes)	1		

Design approach:
The design target was to supply 90 % of the needed energy with the heat pump system. The rest of the energy is supplied with district heating.

Technical issues:
Drilling tests were performed before initiating the project. The installation created some smaller inconveniences for the dwellers but was not really a problem. Good communication with the members of the housing cooperative was obviously necessary.
In order that the heat pumps could work efficiently, the existing radiators had to be replaced by more efficient ones, with a higher heat transfer rate.

Financing issues:
The main reason for the success of the project was that it could be implemented without increasing the condominium fees, so no particular resources were needed.
The energy supply renovation was financed privately. The business model was a renovation promoted, designed and run by an energy service company - ESCO. This meant no or very small economic risk for the housing cooperative. The PV system was financed by the housing cooperative. No challenges were reported for the PV investment.

Policy framework conditions:
The was not an specific policy framework that drove the proccess. It was more market-driven with the ESCO (Skånska Energilösningar) as the main initiator.
Neither other links nor networks were involved during the proccess.
No regulations hindered or stimulated the process.

Lessons learned

The main lesson and at the same time the main transfer from this success story is the extreme importance that the ESCO company, Skånska Energilösningar, played. They contacted the housing cooperative and offered a financial solution that was perceived to carry a very low risk by the housing cooperative.

No main bottlenecks were identified. One possible technical bottleneck was that the radiators in the buildings had to be upgraded to new ones with a higher heat transfer rate. However, this was not really an issue as it was solved without hindering the process.