Case study : Vallda Heberg - Sweden

Name of the project:	Vallda Heberg
Adress of the project:	Vallda, Kungsbacka (25 km south of Gothenburg) - Sweden
Name and type of the owner:	EKSTA Bostads AB - Municipal housing company - www.eksta.se
Owner contact person:	Christer Kilersjö, managing director - christer@eksta.se

A/ Context of the study

A.1/ Motivations

EKSTA Bostads AB (municipal housing company) has built and operates a number of solar assisted heating plants in small residential building areas, the first ones from the 1980's. The heat supply is managed via small district heating systems based on wood chips and/or wood pellet boilers and roof-integrated solar collectors of different generations, i.e. 100% heating by renewables. The buildings, commonly small multifamily buildings, school buildings, etc., have always had a bit lower heat demand than required in the Swedish building code. The new building area in Vallda Heberg comprises multifamily buildings, as well as single family buildings, with even lower heat demands than previous areas, and is thus a bit of a challenge for a central heat supply system.

A.2/ Description of the existing DH

Buildings - Vallda Heberg comprises 26 single family buildings, four multifamily buildings (4 apartments per building), 6 row houses with 22 units and a nursing home for elderly people with 64 apartments, all together about 14 000 m2 heated floor area. All buildings are designed as "passivhus" (Swedish definition), i.e. well insulated buildings with air tight envelopes, and supply and exhaust ventilation with heat recovery is applied in all buildings. Furthermore, there is an air heating coil in the supply air for heating when required and heat driven white goods (e.g. washing machines), in the residential units.

Heat supply - The local district heating system comprises one central heating plant with a 250 kW wood pellet boiler (and an oil boiler for back-up), a buffer storage tank and four sub-stations (SS1-4) with buffer storage tanks and hot water circulation systems. There are further 108 m2 evacuated tube solar collectors on the heating plant and 570 m2 flat plate roof-integrated solar collectors in connection to the sub stations. The primary heat distribution comprises a 2-pipe system between the central heating plant and the Sub-stations. The secondary heat distribution comprises a 2-pipe hot water circulation system between the sub-stations and the connected buildings. The circulating hot water is further used to heat the buildings when there is a heat demand.

Building area development - The residential area is to be developed over a period of 2 years. The single family buildings arer to occupied end 2012, while the other buildings are to be occupied late 2013. The heat supply system, including solar collectors, has been put into operation in steps in order to supply heat to occupied buildings.

Design calculations - Table 1 summarises the calculated heat demand for space heating and Domestic Hot Water (DHW) in all buildings connected in the initial building phase. The buildings have, as mentioned, their heat supplied via four Sub-Stations (SS). Table 1 shows also the calculated heat demand for space heating and DHW in single family buildings, as well as the solar collector areas, connected to sub-stations 1 and 2.

Reference - The project was presented with some initial experiences in a paper presented at the 2nd SDH Conference in Hamburg in June 2014.

A.3/ Environment data

Annual solar radiation on south facing tilted area 1 100 kWh/a.m2.
Annual ambient temperature 8 degC.

A.4/ Opportunities and barriers

The main challenges are related to a new heat distribution system and a new type of solar collector applied on the heating plant.

B/ Methodology and tools used in the study

B.1/ DH load profile

The heat demand in the buildings was estimated using VIP+ a common Swedish sofware. See Table 1 below.

B.2/ SDH design and sizing, energy balance

The design of the solar systems is primarily based on rules of thumb together with some initial calculations with Polysun. The design rule of thumb is 6-8 m2 solar collector per residential unit and buffer storage volume of about 100 m3/m2 solar collector area. See Table 1 below. The design intention is that the solar heating systems should provide up to 40% of the total demands for DHW and space heating in connected buildings, while the remaining 60% mainly during the heating season are covered by the central wood pellet boiler.

C/ Results of the study

C.1/ SDH system design, energy balance and performance

Table 1. Calculated heat demands and collector areas SS1 and SS2.

	Heat [kWh/a]	Units [-]	Specific [kWh/a.m2]	Total [kWh/a]
Single	7 800	26	55	202 800
Senior	3 400	22	52	74 800
Multi	15 400	4	48	61 600
Com.	12 700	1	62	12 700
Elderly	269 000	1	37	269 000
Total				620 900
			Solar coll. Aper. [m2]	
SS1	7 800	19	142	148 200
SS2	7 800	7	38	61 600

C.2/ Heat production management at network level

The local solar heating systems heat buffer storages which in turn heat the DHW circulation for the connected buildings. The central heat distribution with the wood pellet boiler is heating the buffer storages when necessary during the summer and the whole heating season.

C.3/ Economics at SDH level and at network level

The investment costs (incl. plants and heat distribution system) are recovered by the price of the single family buildings and via the rent in rented buildings. The operation cost (wood pellet) is recovered by selling DHW and heat to the single family building owners and the tenants.

1. The total heated building floor area is 14 000 m2. The total investment cost is about 15 000 - 20 000 SEK/m2 heated floor area and thus the total investment cost is 210-280 MSEK. The total collector area is close to 700 m2. The total solar investment cost is 3 500 - 4 000 SEK/m2 and thus the total investment cost about 2.5-2.8 MSEK. The solar system represents thus about 1% of the total investment cost which within the error margin of the total contract cost.

2. The solar system contribution is estimated to about 250 MWh/a. With an investment oc 2.5-2.8 MSEK and annuity 0.05 the solar heat cost is 500-600 SEK/MWh (50-60 €/MWh).

Authors

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