Ljuskärrsberget

- the largest ground source heat pump project in Sweden

ENSTAR AB is a Swedish company that designs, delivers and maintains large heat pump solutions for buildings. Last year, ENSTAR AB delivered the largest ground source heat pump project ever in Sweden, based on the total length of boreholes: 35.880 meters.

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The customer, Brf Ljuskärrsberget, consists of several buildings with a total of 500 apartments. The area is located in south Stockholm. Approximately 1000 residents live in these apartments, and all residents are represented by a board with the responsibility to insure that necessary improvements, investments and maintenance of the property are made in both the short term and, as in this case, long term. This kind of organisation and ownership is quite common in Sweden and involves all the apartment holders in larger investment decisions. The decision taken in May 2010 by the Brf Ljuskärrsberget board was definitely a large one - the total investment was 60 MSEK (approx 6.5 MEuro).

The easiest part of the decision was the ground source heat pump system which is, in Sweden, an ordinary solution from a technical point of view. The more difficult part to decide was if, when and how to convert the existing direct electric heating system to a modern distributed water heating system. 500 apartments and 1000 residents meant many different opinions and thoughts. The project started with a preliminary study in 2006. After two years with the help of energy consultants to make an evaluation of every applicable solution available on the market, the board concluded that a distributed water heating system in combination with ground source heat pumps would be the best solution in the long run. One component in the financial evaluation was the availability of a governmental subsidy worth approximately 10 MSEK (1 MEuro), based on the combination of heat pump technology and conversion to a distributed water heating system at the same time. However, this strategic decision taken by the board in 2008 required confirmation by all the residents. It took two years, a lot of information, meetings and voting to finally get full support for the project.

The contract was signed in late June 2010, and the project was initiated quickly with drilling activities started in early July 2010. The scope of the project allowed different phases of the work – drilling, installation of radiators, installation of heat pumps, etc. – to go on simultaneously, and by February 2011, all buildings were heated with the new system.

The inside-the-apartment heating system is quite conventional and we will here focus on the heat production part of the total solution, although the distribution part has a major role in the whole project.

System description

The facility is divided into 13 groups of four buildings, each served by its own central plant located in one of the four buildings. The heated water is distributed directly in the building housing the central plant room and through a culvert system to the other three. When designing the system, there was an option to build one single central plant to serve all 52 buildings. However it would have been a less efficient solution in this case, due to high transmission distribution losses and higher investment costs. The so-called satellite solution used here is preferable under some circumstances.

Each group of buildings has a borehole configuration with 12 boreholes connected through collection wells which reduce the number of pipes going into the central room. A very vital part of the design work was to simulate and analyze the whole system before deciding the required total length of active borehole and the exact locations and angles of the boreholes.

Domestic hot water is also provided by heat pumps and as a supplementary solution there are electric boilers in the water heaters if needed temporarily.

Integrated processors in each heat pump communicate via remote control units, and it is possible to monitor and manage all 13 systems remotely.

The Benefits and Outcome

Before the installations, the electricity consumption for heating and domestic hot water was approximately 5200 MWH per year. With the new ground source heat pump system the consumption is anticipated to drop to approximately 1626 MWh/year. Since the project is recently finished we are awaiting the result of a 12 month monitoring period next year. In economic figures the savings will be nominally near 4 MSEK (440 000 Euro) per year based on 2010 electricity costs. Since then the prices have increased and result in even larger savings. Taking into account capital costs and depreciation the savings are as large as 3 MSEK (330 000 Euro) per year when calculating on the part of investment which is dedicated to the ground source heat pump solution. All in all, based on a 60 MSEK (6.5 MEuro) investment there are still savings at 1,5 MSEK (160 000 Euro) per year after capital costs and depreciation for the complete system.

The environmental benefits are huge. The new solution will reduce CO_2 emissions by more than 350 tons per year. The figure is based on the 2010 average emission value from Nordic produced electricity which is traded at Nordpool. The customers have plans to convert the existing contract into a contract based on "Green Electricity". They have also investigated the possibility and benefits from investing in wind power, as a part ownership in a large scale wind power plant. In these both scenarios the CO_2 footprint will be nominally reduced to zero.

Another interesting and positive effect for the householders is the indoor climate. Before the installation of the new system, the electric radiators heated the space unevenly and with the new distributed water heating system the air temperatures are much more uniform and the indoor climate has become much more pleasant

To summarize, Brf Ljuskärrsberget has taken a big step from costly direct electrical heating to invest in a cost efficient ground source heat pump system. Even though the investment is high, the achieved cash flow effect from year one will be positive. In the long term they will save millions of Euros. However the biggest winner in this case is the environment.

Mathias Skoglund, chair of the Brf Ljuskärrsberget board and Jan Enegård, ENSTAR AB. Photo: ENSTAR AB

Fact box:

Total heat pump capacity: 1.3 MW

Supplemental electric boilers: 780 kW

Number of heat pumps: 26

Number of boreholes: 156

Borehole depth: 230 meters per borehole