

T@W Good Practice Form

Setting

Title:

Public-private Partnership Leading to a New CHP Plant Utilising Fibre Sludge and Biomass

Country:

Sweden

Location:

Mariestad in West Sweden Region

Start date:

1999

End date:

2002

Technology keyword(s):

Industrial waste, Forestry & energy crops, Combined heat & power

Host:

Katrinefors Kraftvärme, Mariestad

General description

Summary:

In 1993 the establishment of district heating started in Mariestad, Sweden. To develop the district heating network a new production system was needed. This was the first step towards today's new combined heat and power (CHP) plant. The only suitable location for the plant was in the middle of the community at Metsä Tissue, the paper industrial plant, so the scheme would require their co-operation. A feasibility study assessed that the best solution was to build a plant for both the community district heating and the paper plant. This meant that the new plant had to be able to supply steam which would give the opportunity to generate electricity as well as heat. A new company was founded, Katrinefors Kraftvärme AB which is owned jointly by Metsä Tissue and the local community owned utility MTEAB.

The new CHP plant is utilising the fibre sludge from the nearby paper industry together with biomass (forestry residues) to generate heat to the district heating system, steam to the paper industry and electricity to the grid. The fibre sludge is a residue from the recycled paper that cannot be used for soft paper production but gives energy when combusted. Prior to this the sludge was disposed of at landfill. The concept is built upon proven technology but a similar CHP plant of this size had not been built before in Sweden



Figure 1 the CHP plant

In April 1999 procurement was initiated and the new CHP plant went into operation in early 2002. The plant supplies about

240 GWh/year; 105 GWh as steam, 106 GWh for district heating and 29 GWh of electricity. The total investment was SEK 200 million.

Aims:

The aim was to utilise the fibre sludge from the nearby paper industry together with forestry residues to generate heat for the district heating system, steam to the paper industry and electricity to the grid. In this way the community district heating network could be developed and the steam supply to the paper industry secured, all by utilising the residue fibre sludge and biomass.

Summary of Results:

The CHP plant went into operation in early 2002. In 2005 the plant supplied about 227,5 GWh; 87,2 GWh as steam, 115,9 GWh for district heating and 24,4 GWh of electricity.

Planning Time: 7 years from conception to end of building

Planning issues: n.a

Operation Time: n.a

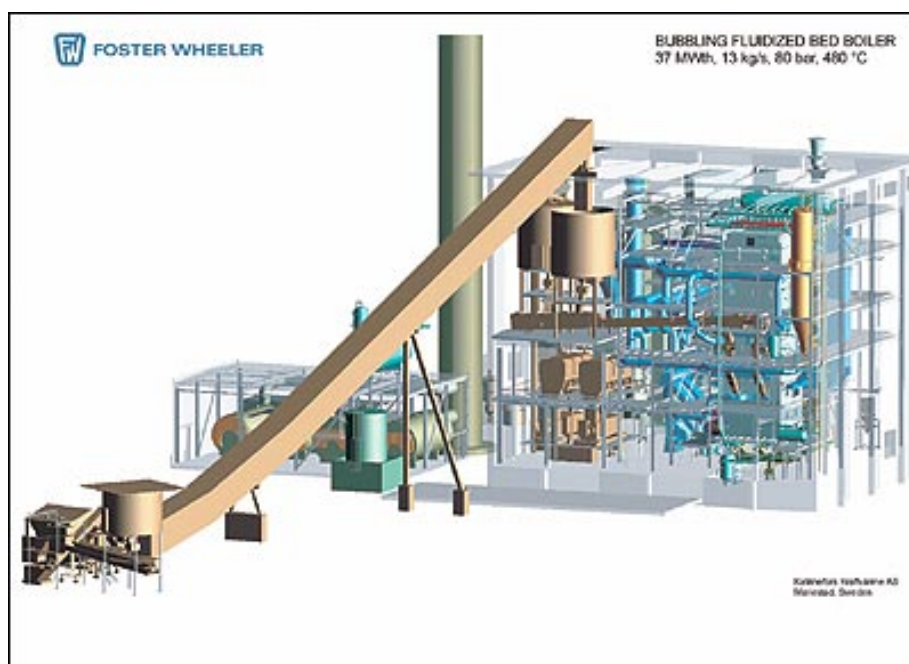
Feasibility Study:

The first feasibility study was carried out in 1995 which assessed that the best solution was a partnership between the municipal utility, who were operating the community district heating network, and the paper company. In 1996 a company equally owned by these was established. Since then there has been research for district heating solutions using steam production as well as co-generation.

Technical details

Technical details:

The biomass boiler is a fluidised bed with a capacity of 36.9 MW and minimum load requirement of 10



and minimum load requirement of 10 MW. The pressure and steam system is designed for operation at 480 °C/80 bars. A low combustion temperature of 850 °C combined with a low inlet air surplus gives low-NOx contents in the exhaust gases. Ammonium is also added to further decrease the NOx emissions. The biomass and fibre sludge used

Figure 2 Fluid bed boiler building

has a moisture content of 45-55%. The flue gas condensing system gives a further 11 MWh capacity for district heating. The turbine has an electrical capacity of 9.5 MW; the thermal capacity is 27.2 MW.

For back up and peak load four oil boilers of each 15 MW is used, two for hot water production and two for steam generation. The plant also has a hot water accumulator of 2,000 m³ for the district heating supply. The tank height is 34 m and the maximum temperature is 99°C. The maximum storage capacity equates to about 100 MWh. The accumulator enables a more even boiler load and increased efficiency of the system.

The biomass supply capacity is designed for 200 m³/hour. The storage volume is 4,000 m³ which corresponds to three days of operation at full load. The fibre sludge from the paper industry consists only of 3% of combustible material. After dewaterisation, the moisture content is 45-55%.

Energy data

Energy data:

The Katrinefors CHP plant was built to replace up to 25,000 m³ of heating oil. The annual supply of fibre sludge from the paper plant gives about 58 GWh. The forestry residues which are mixed with the fibre sludge provide about 158 GWh annually. This requires around 2,100 truck loads, each of 100 m³, per annum.

The flue-gas condensing system recovers heat equivalent to 43 GWh/year. As back-up there are four oil boilers with a total capacity of 60 MW. These will only generate 7 GWh/annum. In total the plant is supplied with about 260 GWh of fuel energy content. During the first few years production will be about 240 GWh/year: 105 GWh supplied as steam, 106 GWh from district heating and 29 GWh of electricity.

Electricity production can be increased to 45 GWh if, for example, the electricity price increases. The future increase of district heating in Mariestad is also an important consideration for the electricity output as the outlet steam from the turbine is utilised for district heating in combination with heat from flue-gas condensing.

The operation of the CHP plant has meant that since 2002, the district heating system in Mariestad has been fuelled mainly by renewable energy. 55% comes from biomass (forestry residues), 23% from the fibre sludge and 18% from flue-gas condensing. Only 4% of oil is used and, in total, about 25,000 m³ of heating oil is replaced.

Energy saved/generated: 864000 (GJ/y)

Monitoring: n.a

Environmental data

Environmental data:

The Katrinefors CHP plant is built to replace up to 25,000 m³ of heating oil. Ammonium is added in the fluidised bed boiler to decrease the NO_x emissions.

The exhaust gas cleaning system consists of two textile filters, each with a 70% capacity. Activated charcoal can be added to decrease the emission of dioxins, but so far this has not been necessary.

The ash from the fluid bed as well as the fly ash from the textile filters is separately handled. The landfill mass has decreased from 70,000 tonnes/year of fibre sludge to 7,000 tonnes/year of ash and alternative use for the ash is under investigation.

Project GHG-emissions:

GHG-emission reductions: 90 000 tonnes CO₂equivalent/year

“EAU, CER, ERU, AAU”:

Methodology:

Baseline

Monitoring:

Contribution to Sustainable Development:

The project has transformed an industrial waste-problem to an energy source. Combined with the CO₂ reduction, due to replacement of small oil boilers in the community with district heating and replacement of oil in the district heating system with renewables, the project contributes in a significant way to sustainable development. The public - private partnership demonstrate great coordination gains and the possibility of mutual responsibility for local and global environment. The project can also create local job opportunities when the oilfuel is replaced by biomass.

Economic data:

Financing:

The project has received SEK 58.5 M of government support as a proportion of the total investment of SEK 220 M. SEK 30 M was received from the local investment programmes for environmental actions. SEK 28.5 M was granted by the Swedish Energy Agency from the programme for increasing biomass CHP installations. The grant gives SEK 3,000 per installed kW of electric power installed. The remaining part of the investment is covered by the company.

Capital cost: SEK 220 M

Operational Costs:

Payback:

Energy Production costs:

Other savings:

Additional Information

Project Web site: www.kkab.com

Contact information:

Type of Organisation:	Host Company
Technology keyword(s) specific to this organisation:	
Organisation / Agency:	Katrinefors Kraftvärme AB
Main contact	Rolf Åkesson
Address:	Box 102, 542 21 Mariestad
Tel:	+46 501 637 11
Fax:	+46 501 39 34 40
E-mail:	rolf.akesson@mteab.net
Web Site:	www.kkab.com