Feasibility Study

Solar plant with district heating net (Austria)

Elaborated by

DI Horst Strießnig
DI Philip Ohnewein

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nahwaerme.at
Energiecontracting GmbH & Co KG
Herrgottwiesgasse 188
8055 Graz, Austria

☎ 0316 – 29 28 40
0316 – 29 28 40-28
www.nahwaerme.at

General information

Until 1991, a district heating network was constructed in the village with about 1000 inhabitants including all house service connections. In the following years, the heating central was built. The district heating supply started its operation at the end of 1992. Three years later, the Österreichische Fernwärmegesellschaft (ÖFWG) purchased the whole plant including the district heating distribution network. The ÖFWG expanded the boiler capacities, so nowadays the district heating plant includes two biomass-fired boilers and two light fuel oil fired boilers (see the table below for capacities).

General site overview

Technical specifications district heating net

district heating main length	4,700 m
water content of district heating pipeline (incl. boilers)	30,000 liters
pipe dimensions	DN 15 – DN 150
nominal pressure	PN 16
temperature levels (primary side)	90°C supply / 60°C return
no. of house service connections	72 (total: 1,800 kW)

Technical specifications heating central

installed boilers	biomass boiler 1	800 kW
	biomass boiler 2	1,000 kW
	oil boiler 1	760 kW
	oil boiler 2	760 kW
	total	3,320 kW
fuel consumption per year	biomass (wood chips)	6,000 m^3 (steres)
	light fuel oil	70 tons
produced energy at heating central		4,000 MWh per year

Biomass storage room

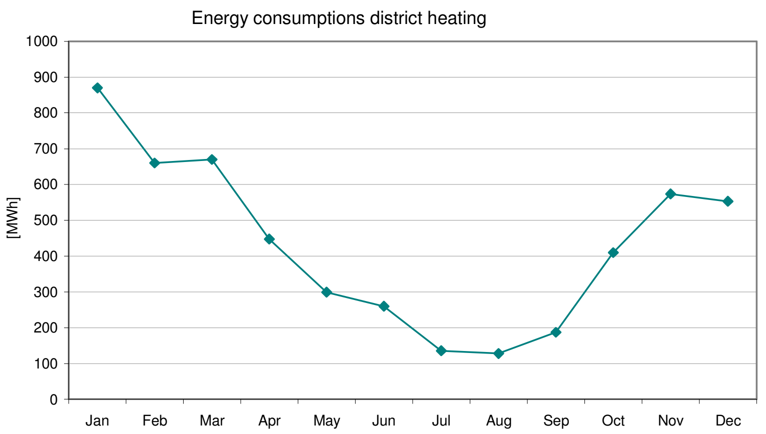
Solar plant concept

The biomass boilers are wood chip fired and cover the base load. As soon as the energy consumption exceeds the base load range, the oil boilers are fired in order to cover the peak loads. Moreover, the oil boilers can be used in case the biomass boilers should have some kind of failure. In summer, the biomass boilers are usually turned off, and one or both of the oil boilers cover the low energy consumption, especially in the months May to September. See the table below and the energy consumption profile for more information.

The idea of including a solar thermal plant into the existing district heating network system is the one of covering the summer loads entirely with solar energy. Thus, the biomass and the oil boilers could be completely turned off in summer. This is even more important as due to the low boiler capacities in summer, the summer boiler efficiencies are very low. Therefore, by its summer operation, the solar plant reduces the primary energy consumption to a comparatively large extent.

Yearly energy consumption profile of the district heating net

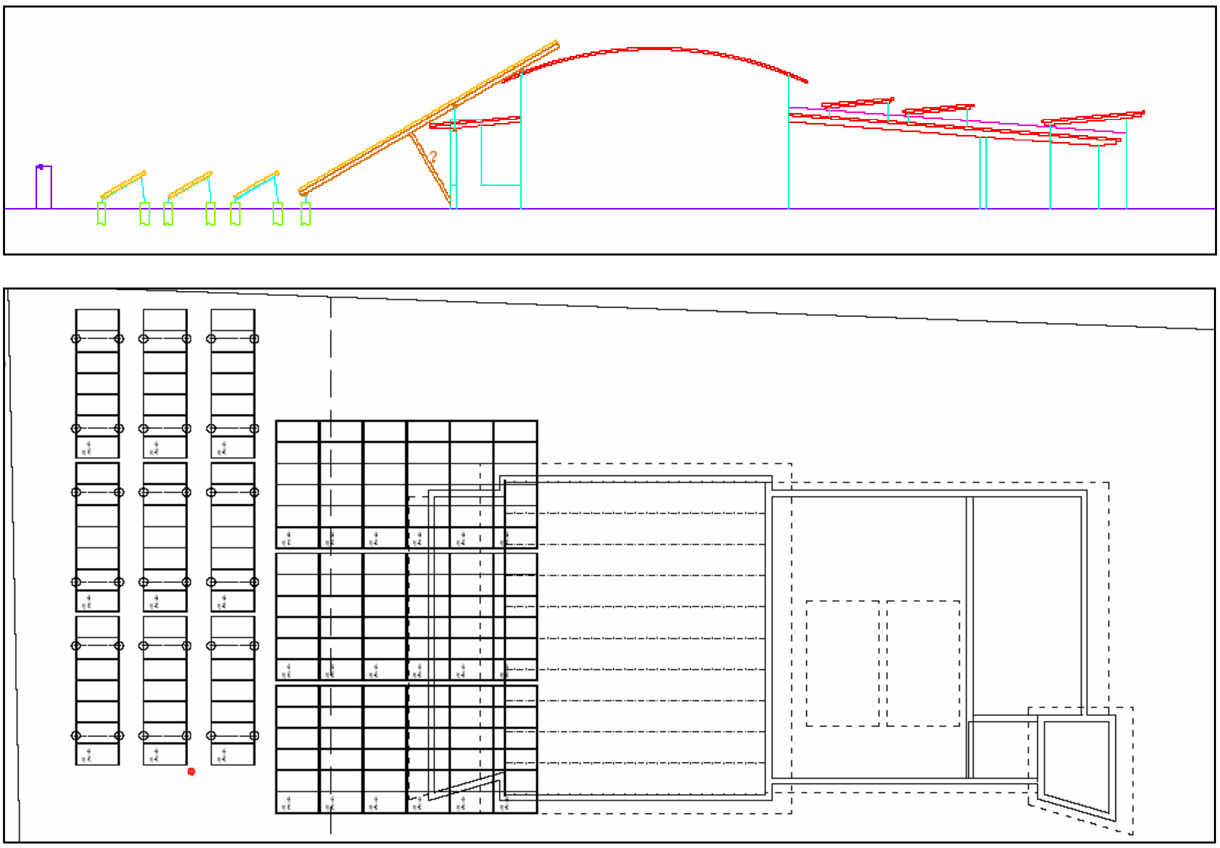
Jan	870	MWh
Feb	660	MWh
Mar	670	MWh
Apr	448	MWh
May	299	MWh
Jun	260	MWh
Jul	136	MWh
Aug	128	MWh
Sep	187	MWh
Oct	410	MWh
Nov	574	MWh
Dec	553	MWh



Solar plant operation mode

Here is, in short, the mode of operation of the solar plant. The solar plant operation mode is called a return flow booster. This means that the solar plant has the task of elevating the temperature level of the return flow of the district heating net. In case the temperature after the energy feed-in from the solar plant is high enough to serve the net, no further afterheating from the oil boiler(s) is necessary. For the solar plant, the main advantage of the return flow booster operation mode is that it always gets the lowest possible temperature level.

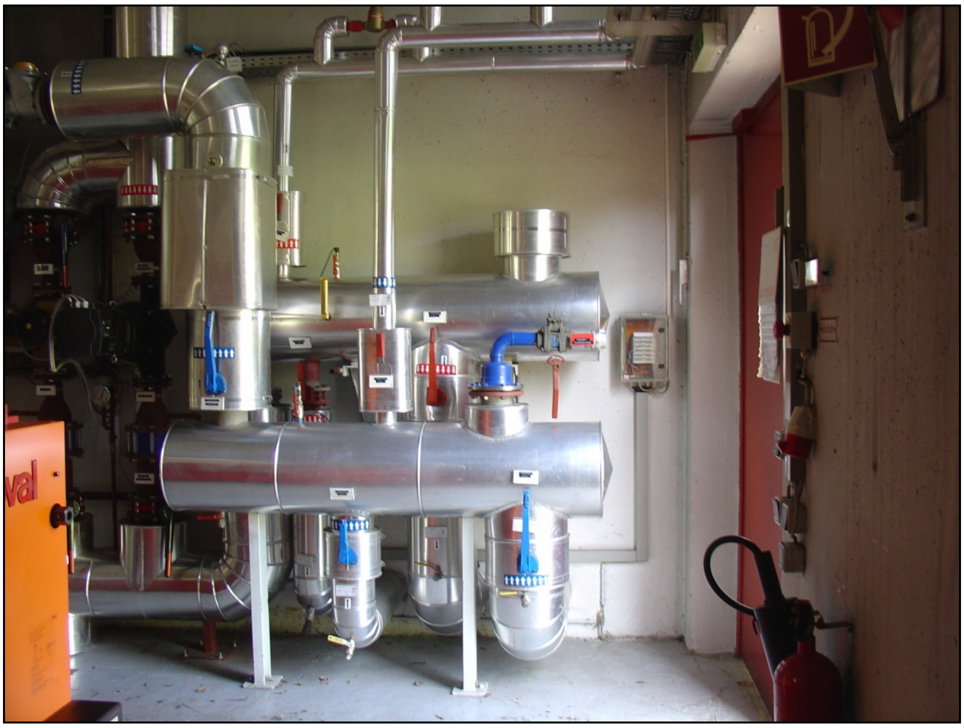
Site view (incorporation of solar plant)



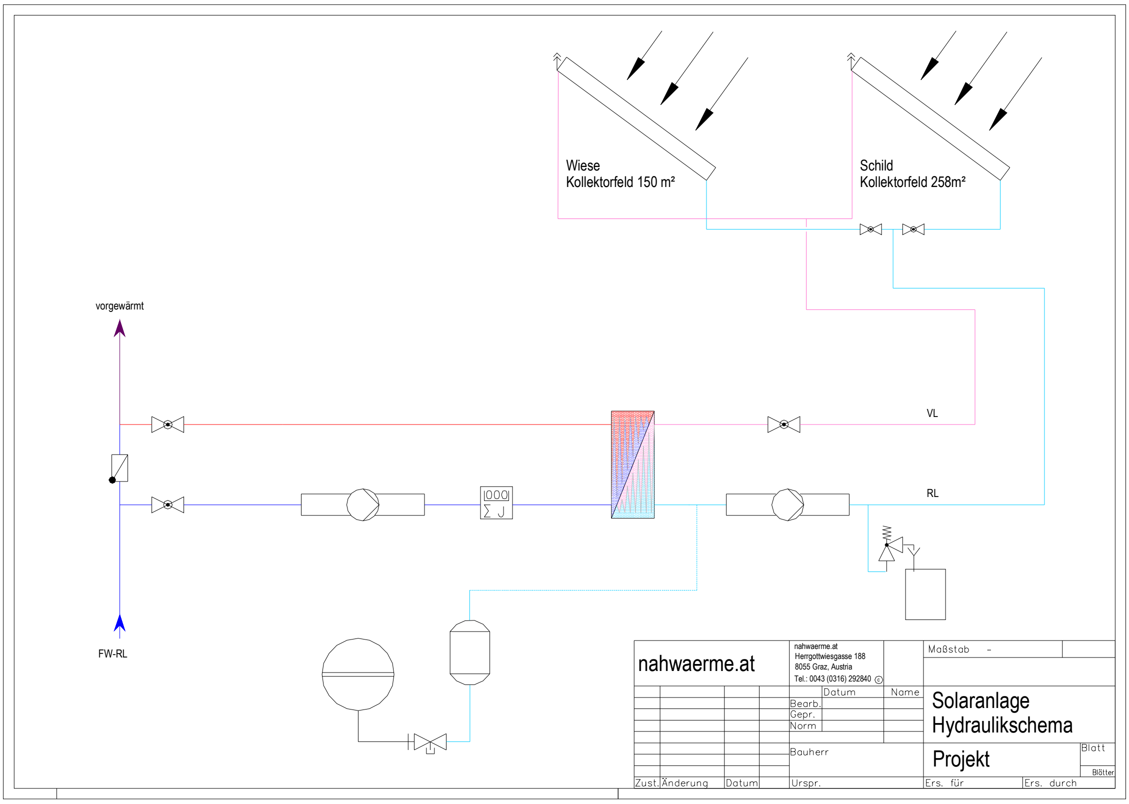
As can be seen from the picture above, the main collector array of the solar plant is situated on part of the roof of the heating central / biomass storage. Another 3 collector arrays are placed in front of the heating central, directly on the ground. The advantage of these collector arrays is the low cost of the collector substructure when placed directly on the ground.

The main collector array is mounted on a specially constructed and designed substructure and comprises 257.40 m², the 3 collector arrays in front of the heating central total 150.30 m², thus adding to a total gross solar collector area of 407.70 m². The solar pipelines are lead directly into the heating central. No installation of a solar thermal storage is foreseen. A simplified hydraulic scheme can be seen in the picture below.

Due to the operation mode of the district heating net, relatively high temperature levels will occur in the solar plant. In consideration of this fact, in the project an improved flat plate collector will be used. This collector type has considerably less heat losses at higher temperatures and thus an increased efficiency.



Simplified hydraulic scheme



Contractual aspects

The company solar.nahwaerme.at Energiecontracting GmbH builds the solar plant at its own cost and assume the financing plan. The financing of the plant is done partly by public subsudies and partly by bank loans. The solar.nahwaerme.at Energiecontracting GmbH commissions the company S.O.L.I.D. GmbH with the construction and installation of the solar plant.

The main contractual partner of solar.nahwaerme.at Energiecontracting GmbH is the customer for the energy feed-in, the Österreichische Fernwärmegesellschaft mbH. Both parties signed an agreement that all solar energy delivered by the plant can be supplied to the district heating net. Besides a low energy price for the solar energy, another advantage for the whole municipality of the village is the fact that the oil boiler emissions will be clearly reduced by the solar plant; this is even more important as the village is a climatic spa.

The construction of the plant is foreseen to start in autumn of 2006 and will be completed in the end of 2007.

Economical aspects

SYSTEM DATA

Basic system description

Plant size (m²)	408,00
Net energy demand (kWh/year)	5195000,00

Economic data

Fuel of conventional system	Oil
System efficiency (%)	60,00
Heating value of fuel (kWh/m³)	0,00
Conventional energy price (€/kWh) (CEP)	0,06
Decrease in conventional boiler efficiency (%)	2,00

Economic data

Total investment cost (€)	167688,00
Subsidies (€)	73754,00
Total financing amount (€)	63934,00
Interest (%)	5,00
Specific investment cost (€/m²)	3,48

System Ongoing Cost

Monitoring costs (€/year))	500,00
Service and maintainance (€/year)	500,00
Who pays de electricity?	
Electricity consumption (%)	3,00
Electricity price (€/kWh)	0,08
Other costs (insurance,etc)(€/year)	0,00
Total ongoing costs (€)	1419,10
Specific system ongoing costs (€/m²)	3,48

Solar system savings

Reduction of ongoing costs for a conventional energy supply system due to solar plant (€/year)	0,00
Economic benefits due to increase of service life of conventional energy supply system (€/year)	0,00
Reduction of investment costs on the conventional energy system due to the solar plant (€)	0,00
Improvement on efficiency of the conventional system boiler (€)	0,00

CONTRACT DATA

Contract definition

Increase in conventional energy price (%)	4,00
Increase in electricity price (%)	5,00
Increase of consumer price index (%)	3,00
Property of the plant after the end of the contract	EsCo
Price of the solar plant for the end-user at the end of the contract (€)	30000,00
Contract period (years)	20,00
Invoicing sections	1
Standard discount (%)	8,00

Section 1

Energy under guarantee (kWh)	150000,00
Period for the invoicing section (years)	20