Case study : BEA Desio (Italy)

Name of the project: Desio

Address of the project: Desio

Name and type of the owner: DH supplier

Owner contact person: Giorgio Tominetti (giorgio.tominetti@beabrianza.it)
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A/ Context of the study

A.1/ Motivations

Planning to extend the existing DH network, BEA DESIO wants to increase the thermal energy capacity of the network in a renewable way. Furthermore, they want to make first experiences with solar thermal systems. This study is in between 3.1 and 3.2, as the plant would be connected to the existing grid, which though will be extended in the near future.

A.2/ Description of the existing DH

The district heating pipelines extend for about 20 km (both supply and return pipes). The heating needs of the distict heating is provided by 3 boilers of 10 MW each (30 MW total) and by steam bleeding system from the steam turbine. In this network are also present 2 condensers (total power=16 MW) that work simultaneously (one is an air-condenser, while the other one is water-condenser). There are also some absorbtion chiller used in summer along the network and 800 m2 heat storage.
Electricity production and condensation are lower in winter, due to the higher use of DH (2,5 MW in winter, 4 MW in summer).

Temperature and flow

in winter:

- -Tforward 92 °C
- -Treturn 68 °C
- -Flow (nominal) 550 m3/h
- -Flow (max) 700 m3/h

in summer:

- -Tforward 92 °C
- -Treturn 68 °C
- -Flow (nominale) 250 m3/h

The total annual thermal energy consumption has been **49 GWh**.

A.3/ Environment data

For what concerns the weather conditions, we used Meteonorm (meteonorm.com) hourly data of air and ground temperatures, air relative humidity and solar irradiation in Milan. Here a summarizing table of average monthly conditions:

MONTH	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
n° Days	31	28	31	30	31	30	31	31	30	31	30	31
n° Hours Day	278	283	359	395	456	450	465	424	373	326	284	279
n° Hours Night	466	389	385	325	288	270	279	320	347	418	436	465
T ext. air max [°C]	11.8	16.6	18.0	21.2	25.5	29.8	32.2	30.7	29.2	23.1	17.5	12.4
T ext. air min [°C]	-7.4	-6.9	-4.3	-1.4	4.7	8.3	11.7	11.0	7.9	1.8	-3.8	-7.3
T ext. air ave [°C]	1.6	3.2	7.2	10.5	15.6	19.2	22.3	21.7	18.1	12.3	6.0	2.2
T ground ave [°C]	14.0	12.7	11.8	11.4	11.7	12.6	13.9	15.3	16.2	16.6	16.3	15.3
Relative Humidity [%]	83.8	78.4	72.0	76.5	72.7	72.9	71.6	72.8	75.4	79.6	83.6	84.0
Irr max H [W/m²]	420	562	713	864	901	923	897	897	762	600	408	312
Irr ave H [W/m²]	117	178	267	327	355	398	404	385	312	223	126	99
Rad tot H [kWh/m²]	33	50	96	129	162	179	188	163	117	73	36	28

A.4/ Opportunities and barriers

OPPORTUNITIES: very high motivation in solar DH an also availability of land owned by DH supplier near the power station

B/ Methodology and tools used in the study

B.1/ DH load profile

A detailed load profile (with a timestep of 2 hours) has been provided directly by the DH supplier and used as input for a TRNSYS simulation, which calculated the solar energy input into the grid on hourly basis, including return temperature increase.

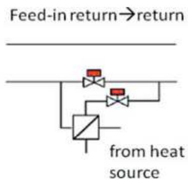
B.2/ SDH design and sizing, energy balance

The design of the SDH is "feed-in return-->return".

We used TRNSYS because it is more flexible than other softwares (e.g. TSOL): it's easier to put the meteo data as an input file. We also take the hypothesis to model the solar collector like one single, big collector. Collector area is 1000 m2, as this is the maximum area benefitting from incentives in Italy.

The energetic indicators we have taken are:

- *solar energy produced by the solar thermal system (Esol);*
- *efficiency of the plant (Eta plant);*
- *solar fraction(fsol).*



B.3/ Economics

Simple pay-back time. This indicator has been calculated taking into account that solar energy increases the amount of electricity produced by the waste incineration plant, which benefits from green incentives.

C/ Results of the study

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

Results of the study are shown in the following table:

Esol	MWh	412
η_plant	%	32
fsol	%	0.83

C.2/ Heat production management at network level

The objective was to limit the return temperature on the network, in order not to disturb the waste incineration plant. Due to the relatively small collector size, the temperature increase turned out to be limited and acceptable.

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

The cost of 1000m^2 of solar collector is about 267'000€. This value is between 200€/m^2 and 400€/m^2 that represents the unit cost of typical ground installation in Europe. Considering the ground purchase, the infrastructural costs and some other items, the amount on the solar plant is 317'000€.

Since in Italy there are national incentives, for 1000m^2 of solar collector there are 275'000€ distributed in 5 years.

Adding all the items shown before, the total investment, after 5 years is 42'000€.

The energy produced by the solar plant allow the turbine to produce more electrical energy, with the benefit of 9'300€ more every year.

The pay-back time (simple) has been calculated by BEA and is 4.5 years.

Authors

This factsheet was prepared by Stefano Agosteo and Marco Calderoni

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