Case study : Châteaubriant (44) - France

Name of the project: integrating a solar plant in the district heating of Châteaubriant (FR)
Adress of the project: City of Châteaubriant (44) - France
Name and type of the owner: The districti heating is own by the city of Châteaubriant but the service is delegated to COFELY GDF SUEZ (DSP)

Owner contact person:
M. Dominique EGRET - City of Chateaubriant, director of the technical services
M. Jose-Carlos HENRIQUES - COFELY Service, project manager

Context of the study

The Chateaubrian DH is in operation since 2011 under a DSP contract with COFELY. The annual delivery of heat is about 22 GWh, mainly provided by a biomass boiler sustained by natural gas boilers. Heat consumers are public buildings and a collective public dwelling district. Because 2 new extensions of the DH are planned, the city has been interested by evaluating the potential of a solar plant to feed the DH. The aim is to increase the share of renewable energy in the energetic mix, to balance the heat price increase in time and enhance the solar technology and all its advantages. The city has previsoulsy set up a "schéma directeur" i.e a study about the opportunities and the performances of the district heating.
The study has been presented to the city hall council and to the ADEME and was finely received. It should lead to a realization in 2014.

Support

The study has been realized by TECSOL in the framework of SDH+ with the help of CEA-INES and COFELY. It has been financed by the City of Châteaubriant.
The realisation of the solar plant should be granted by the *NTE* (New Emerging Technology) managed by the ADEME ; the DH extension should benefit of grants from the *Fonds Chaleurs* program.

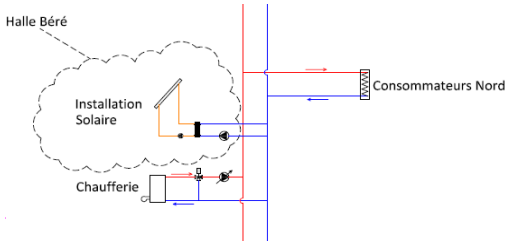
SDH plant

DH technical data

The actual heat demand is about 16,5 GWh/year and heat loss 3,6 GWh/year. With the two new extensions, the future heat production should be extended to 25,5 GWh/y (including losses) where the biomass share is about 73% of the heat production. The heat network is about 7,7 km long, it feeds now 31 substations and 2 news are planned. The operating temperature are about 99/75°C in winter and 85/75°C in summer.

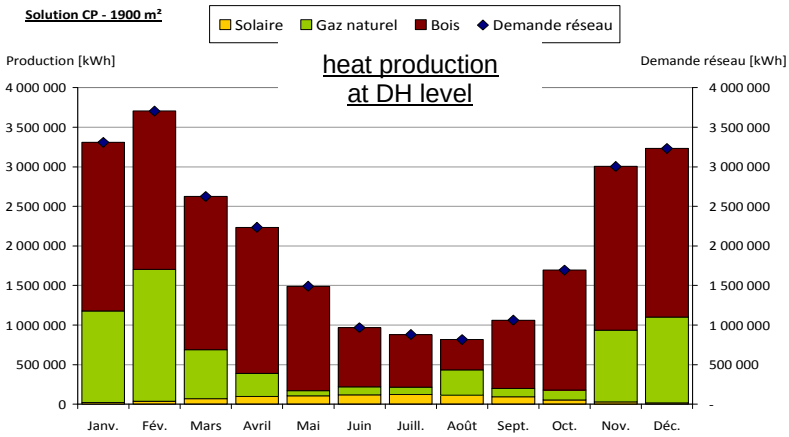
Solar plant system concept and technical data

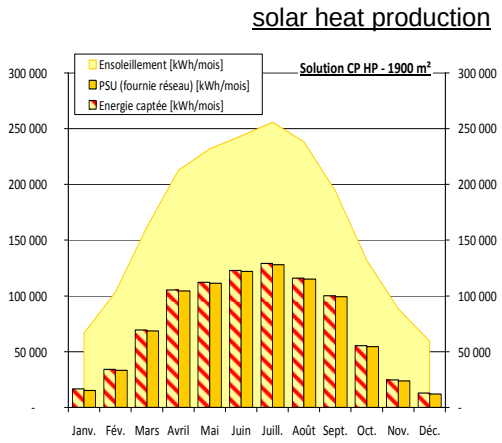
The solar plant consists in a centralized ground-mounted one, with a collector net area of about 1500 to 1900 m². The plant will be connected to one of the main pipe of the district heating network in a "return-return" connexion. A ground has been identified and will be made available by the City to be equiped with collectors. Two collector technologies have been studied : high temperature flate-plate and evacuated tubes. The district heating capacity will be used as a short terme storage.



SDH energy balance

The solar fraction is about 3,5% of the total heat demand for a solar yield of 890 MWh/year





Solution solaire	Demande du réseau [MWh/an]	Contenu CO_2 du réseau [g/kWh]	Production Bois [MWh/an et %]		Production Gaz [MWh et %]		Production Solaire [MWh et %]	
CP 1900 m²	25 028	61,0	17 614	70,4%	6 529	26,1%	885	3,5%
TSV 1500 m²		61,4	17 575	70,2%	6 566	26,2%	887	3,5%

SDH economics

The solar heat cost should be about 100 € /MWh for both FPC and ETC technology (calculated with LCOE method w/o VAT and grants).

The levelized cost of solar energy has been calculated with :
- an actualisation rate of 4%
- a solar plant lifespan of 20 years
- a loan interest of 3,75%

All price are excluding VAT.

Collector technology	flat-plate high temperature
Net collector area	1900 m²
Solar yield	466 kWh/m².an
Investment (CAPEX)	1 138 k€
	599 €/m²
Explotation cost (OPEX)	4,4 k€/an
Global solar heat cost	1 479 k€
LCOE	98,4 €/MWh

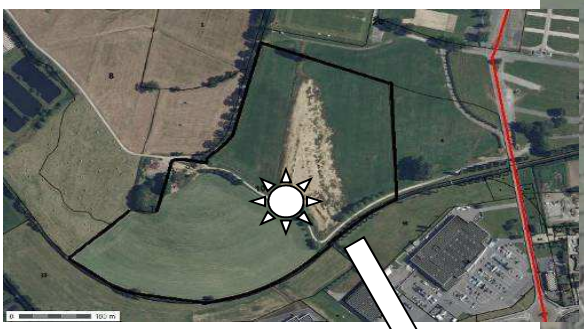
SDH plant opportunities & threats, benefits & limits

Opportunities and Benefits : the city of Châteaubriant is very motivated and will make available for free a ground for the collectors.

Threats and Limits : the actual level of temperature is not the planned one, because of some consummers which require high temperature for the DHW production. Those high temperatures represent a technical barriere to the integration of solar energy in the DH. Some solution will be find to lower the operating temperature. Lowering the return temperature to 70°C should lead to decrease the heat demand of about 15% (production and losses) and increase the solar yield of more than 20%.

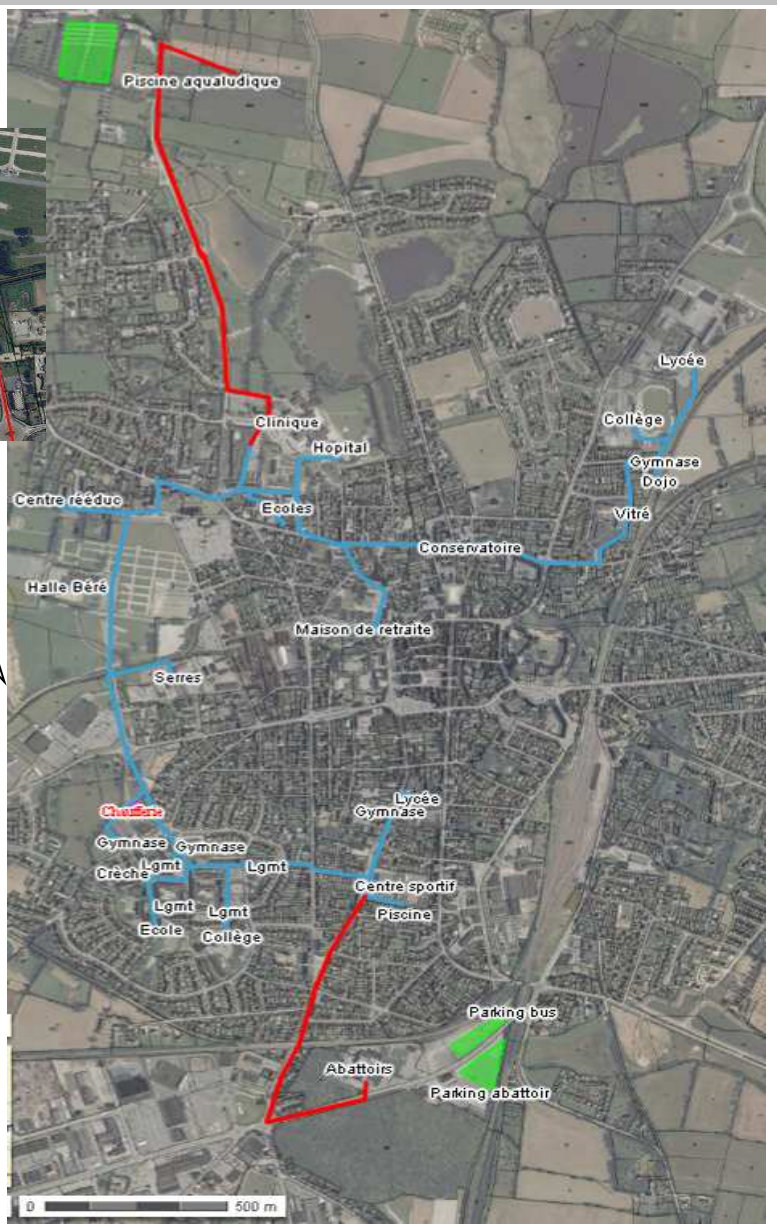
As a conclusion, if the DH temperature is lowered, that the project is a very good opportunity to be the first demonstration solar plant integrated to an existing DH in France.

Photos



solar plant

district heating



Authors

This factsheet was prepared by A. Le denn, TECSOL in January 2014 from data of May 2013 (study realized by C. Plaza - TECSOL) with the help of D. Egret (Chateaubriant), C. Paulus (CEA-INES) and J.P Henriques (COFELY)

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