Case study : Extension of the DH of UEM Metz (67) - France

Name of the project : Integration of a solar plant to the new extension of the DH of UEM Metz (FR)

Adress of the project : Substation Schuman and Supelec of the DH of UEM, ZAC technopôle 2, 57000 Metz, France

Name and type of the owner : the DH is operated under a Public Service Delegation to UEM (www.uem-metz.fr)

Owner contact person : Laurent BLAISE, technical director at UEM Metz

Context of the study

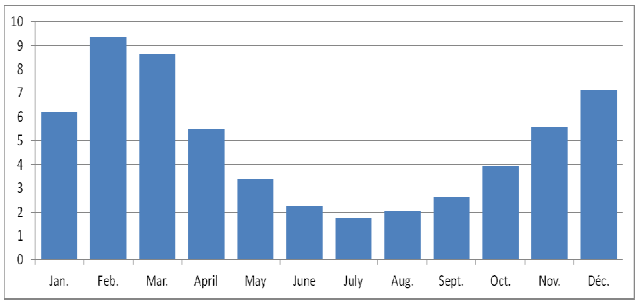
UEM is an energy operator of the city of Metz. This is private company which is majority owned by public actors. UEM manage one of the largest French network with 93 km network representing nearly 400 GWh of heat sold.
In 2013, she became interested in the integration of a solar plant on an extension of the low pressure network to mesh Schumann and Supelec substations. The buildings connected to this extension are mostly school recreational, health and social buildings and some housing and offices.

Presentation of the DH extension

Technical data :
- SST SUPELEC : 3 HP/LP heat exchanger of 6.5 MW
- SST SCHUMANN : 4 HP/LP heat exchanger de 6.5 MW
- existing DH lenght + extension : 3.1 km

Energy balance :
Planned heat delivery : 58.39 GWh

Operation characteristics :
- Control : variable flow rate, return flow temperature control. In substation: modulation with motorised two-way valve.
- Temperature levels : 95/75°C in winter and 85/75°C in summer



Monthly DH load profile (GWh)

SDH plant

SDH system concept

A solar plant made with thermal collector can be connected to the future extension of the DH. The diameter of the grid pide at the connexion point should match the solar heat production. Un 10ha available land has been identified in the new ZAC project. A plant of 3000 m² can be embeded in this place. Regarding the temperature DH levels both technology "High temperature flate plate" or "evacuated tube" collectors can be used.

Technology	flate plate	vacuum tubes
Area unit	12 m²	9,35 m²
$\eta 0$	0,817	0,71
a1 [W/m².K]	2,205	0,95
a2 [W/m².K²]	0,0135	0,005
Size	2,6m x 6m	2,4m x 4,5m

Available place >> for the solar collectors

SDH sizing and energy balance

Several design cases were considered in the study in order to evaluate the influence of some parameters on the solar plant performances :

- A limited investment cost solution, without storage, allowing solar fraction about 2.3% from 2 500 to 2 800 m² of solar collectors producing about 1 200 MWh/year;
- A solution with a solar fraction of 100% in the summer, consisting of 8 000 m² of collectors and 2 000 m3 storage . This solution achieves a solar production of 6 500 MWh/year for annual solar fraction of 12%. However, this solution requires the identification of more lands to plant the facilities.

Conclusions: The solutions calculated in the study with current and lowered DH temperature regimes show the significant influence they have on solar performances. A decrease in the temperature regime of 10°C allows a 20% productivity gains especially in the case of flat plate collectors. The facilities connected in return/return are also more efficient because the temperature levels are lower.

SDH economical balance

The heat cost of the solar system is calculated on 20 years with the formula of the LCOE (levelized cost to overall solar production over 20 years). The solar heat cost is about 95 to 100 € H.T/MWh. Achieving a cost of around 30 €/MWh would require grants of about 10 500 €/ annual TEP, representing 70% of the investment.

Technology	FPC	ETC	ETC+stock
Coll. area [m²]	2 525	2 815	8 000
Solar prod. [MWh/an]	997	1 450	6 723
Invest. (€/m²]	516	641	665
LCOE [€/MWh]	100,4	94,2	59,9
LCOE granted [€/MWh]	36,6	33,4	21,3

Hypothesis : SDH lifespan = 20 years, interest rate 3.75%

Opportunities and limits

Opportunities: the head of the UEM district heating network is very motivated by the project. The funding partners such as ADEME and the Region habe been informed and involved at an early stage of the study.
In addition, a substantial land area is available close to planned DH extension. This would justify the use of inter-seasonal storage and cover much of the summer needs, while reducing the price of solar MWh.

Limits Current operating temperature levels are unfavorable to achieve good performance with solar collectors. Lowering return temperatures should be considered.
The cost of the heat of the UEM DH is very low, and the DH is heated by waste heat on incinerator.

Conclusions and prospects: the price of solar heat is not competitive regarding the current UEM DH heat price, the project has then little chance of success. The grants which can be collected are indeed limited by the rule of European minimis and would be lower than the 70% required to reach 30 €/MWh.

Author

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