Integración de sistemas de calefacción solar en sistemas de calefacción por computadora existentes

Carlo Winterscheid
Intentions of integrating solar heat

Methodology

Solar collector field dimensioning

Storage dimensioning

Simulation results
Project focus

Main-network  CHP-Plant  Sub-network

Project Focus

75°C
Intentions

- Reducing the primary energy factor and specific CO₂ emissions
- Supplying a sub-network independently in the summer
- Flexibility of CHP operation and supply temperature in the main-network
Methodology

MATLAB algorithms

\[ Q_{sol}(t) = \eta_c(t, T) \times G(t) \]

Collector efficiency

Global solar radiation

Solar Radiation \rightarrow Heat Demand \rightarrow Solar Share

System Overview \rightarrow Additional Demand \rightarrow Storage operation

Net solar gain

Solar field size

Storage Size
Collector field dimensioning

- 14% solar fraction
- 38,808 m² of field area
- ~0.1% of subnet-network supply area
Storage dimensioning

Requirements:
- Store the surplus solar heat of a single day

Scenario: Solar Share 14 %
- Specific storage volume per collector area: 40 L/m²
- Storage volume: 730 m³
- Storage capacity: 27 MWh

Fig. Needed storage capacity to store the daily solar energy surplus
Simulation results give load patterns

Additional heat from the main DH-network

Periodic refilling process
Simulation results

a) System Overview

b) Irregular demand

c) Storage state of charge and reheating process
Simulation results

100 % July scenario without recharge

100 % July scenario + night recharge

\( Q_{\text{add}} \)
Integration of solar thermal systems reduces the fossil fuel input at the CHP plant.

Specific CO$_2$ savings of 750 t/ha*) can be expected

*) 1ha = 10,000m$^2$

CO$_2$-emission factor: 172 g/kWh
Integration of solar heat into DH sub-networks:

- Increases flexibility
- Partly independent sub-network operation
- Is an offset between collector field+ storage dimension and independence of the DH main-network
- Reduces the primary energy factor for the sub-network

- Hourly consumption data allow reasonable pre-evaluation
- Should be considered in more projects...
Thank you for your attention!

Contact:
Carlo Winterscheid
+33 76 93 32 183
Carlo.Winterscheid@outlook.com
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