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Preheating of a District Heating Net with a Multicomponent Solar Thermal System

Elimar Frank, Klaus Vajen, Alaibek Obosov, Vitali Borodin

Universität Kassel, Institut für thermische Energietechnik, 34109 Kassel, Germany

Phone: +49 561 804 3892, www.solar.uni-kassel.de, solar@uni-kassel.de

Abstract

The district heating nets that are in operation in many large cities in the Commonwealth of Independent States (CIS) are so-called open nets where vast amounts of cold water of about 12°C have to be heated up to the supply temperature of approximately 60°C before they are directly used for space heating (only in winter) and domestic hot water without any additional heat exchangers. In Bishkek, the capital of Kyrgyzstan which is located at a longitude of 42°N, about 3.000 m³/h have to be heated up at one central Heat and Power Plant using coal or gas burners. Due to the high basic load, the low inlet temperature and outstanding climatic conditions extraordinary solar gains can be achieved using uncovered collectors to preheat the water before it is further heated up to the supply temperature in the boilers (cf. Vajen et al. 1999).

By using heat gains from the environmental air beside the solar irradiance, a serial connection of an air-to-water heat exchanger and uncovered collectors can lead to an even better ratio of solar gains to investment and operation costs. This might further be improved using unglazed transpired air collectors mounted on the façade which heat up the air flow above ambient temperature level during the day (cf. Fig. 1).

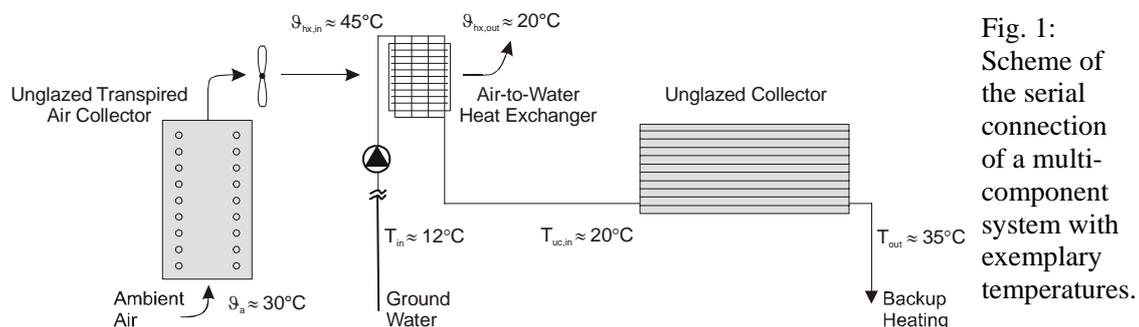


Fig. 1: Scheme of the serial connection of a multicomponent system with exemplary temperatures.

A research plant with a serial connection of all three components has been installed on a heat plant in Bishkek in summer 2004. Results of the measurements will be presented in the presentation. The energy delivery of the different components and the optimal lay-out depend e.g. on the local climate and weather conditions. Due to the serial connection of the components optimisation algorithms have been combined with system simulations in order to determine optimal parameter vectors and the optimisation potential of advanced control strategies. For this kind of application, the serial connection of different solar thermal components has the potential to deliver solar heat at very low costs. First estimations show that even costs in the range of 0.01 €/kWh can be expected.

In the presentation, the general idea of this new kind of solar application will be introduced. Results of measurements, modelling and optimisation as well as approaches to a first commercial system will be explained.

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Literature: Vajen, K., Krämer, M., Orths, R., Boronbaev, E.K. (1999): Solar Absorber System for Preheating Feeding Water for District Heating Nets, Proc. of ISES Solar World Congress 1999.