Results from Parabolic Trough Systems for Process Heat at the DLR Cologne

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Parabolic trough collectors can efficiently supply solar heat to consumers at sites with high insolation. At DLR, Cologne two trough systems have been erected for test and demonstration purposes. They can cover a wide range of applications with temperatures between 50°C – 250°C using air or water as heat transfer medium. In simulations, which have been accomplished with other institutions, it was found, that the use of trough systems in the german climate in combination with seasonal heat storage for district heat supply at a temperature level between 40°C and 100°C is advisable in comparison to flat plate collectors for energetic and cost reasons.

Two rows of a parabolic trough collector from Industrial Solar Technology (IST) serve as a demonstration system and as a testbed to optimise collector components. Collector inlet temperatures and mass flows (and thereby outlet temperatures), which are required for various applications, can be set by a balance of plant. The system consists of 12 modules with a total aperture area of 168 m_ and achieves a nominal power of 85 kW at 800 W/m_ insolation. Maximum operating conditions are a pressure of 20 bar and a temperature of 200°C. The solar field size and the design of the balance of plant allow to simulate applications and to investigate operation and maintenance strategies under realistic operating conditions.

A first series of measurements confirmed the assumed optical efficiency of the collector at perpendicular insolation. Thermal losses are higher than expected though and further research will focus on the reasons for them.

A new development is the line focussing fix-focus collector combined with an air-receiver. It consists of a 36 m_ reflector with 12 mirrors each of 6 m length and a receiver containing a volumetric absorber. In contrast to the „conventional“ troughs the concept requires less space between rows and because of its narrow mirror facettes, wind forces are low, so that the collector is suitable for roof mounting. Better land use and the light construction lead to cost reductions. The receiver is fixed and can therefore be constructed without expensive flexible hoses. In the receiver the radiation falls through a glass cover on a wire mesh, where an air stream, flowing from the sides of the receiver, is heated. By a perforated plate between mesh and outlet-duct a uniform mass flow through the mesh is obtained for an efficient heat transfer. This construction allows a larger cross section than in absorber tubes resulting in a decrease of the power for the blower.

Measurements characterizing the performance of the collector systems will be presented.