COMPARISON OF SEGS SOLAR FIELD PERFORMANCE FROM LABORATORY AND OPERATING PLANT TESTING

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As part of an ongoing program focused on the reduction of O&M costs in solar thermal electric systems, performance testing has been carried out on the two-axis tracking test platform at Sandia National Laboratories and in the operational SEGS VII solar field. In addition, optical measurements have been taken on selected properties, and analytical tools have been developed to predict collector heat losses. This paper will discuss the comparison of test results from a partial collector under the controlled conditions of the Sandia test platform to the results from a large-scale solar test loop at the SEGS plants. Further, observations will be made on the relevance of these test results to the real-world conditions in the solar fields of these particular operating plants.

At Sandia, the two-axis tracking test platform was used to measure collector efficiency, thermal losses and incident angle modifier for two different selective surfaces - black chrome and cermet. Since an important characteristic of the SEGS collectors is an evacuated receiver, which is subject to failure in an operating situation, the effects of loss of vacuum in the annulus and loss of the glass envelope itself were tested At the SEGS VII plant, results are derived from a test loop consisting of two full rows of operating solar collector assemblies. Laboratory testing focused on measurements of absorptivity and emissivity.

The heat loss model utilized in the comparison is a one-dimensional model for an evacuated receiver which was used to quantify the effects of degraded or lost vacuum. Furthermore, estimates were made on the increase in heat loss in the presence of wind for receivers with and without a glass jacket. Comparative results are presented comparing predicted heat loss under test conditions to data from the platform and field testing. Comparisons are reasonably good, though partially limited by the ability to accurately characterize the actual optical properties of the collectors units tested.

Quantification of these effects is an important input to the determination of a cost-effective solar field maintenance strategy for a large solar field. The material and labor costs to replace damaged receivers must be weighed against the performance benefits to be gained to reach a decision on replacement strategy. Clearly, performance impacts must be accurately estimated to quantify the operational losses associated with leaving the solar field receivers in a deteriorated state.