

Abstract

In the present work, a novel parabolic trough solar collector model has been developed and validated. The validation has been carried out through a comparison with results of previous studies conducted in the worldwide most renowned laboratories, i.e., Sandia National Laboratory (SNL) and National Renewable Energy Laboratory (NREL). The comparison with experimental data collected by SNL, during LS-2 tests at AZTRAK platform, has shown good agreement, particularly for the case of receivers with Cermet coating. When compared with the Engineering Equation Solver (EES) code developed by NREL, the novel model offers improvements in the accuracy of thermal performance prediction. It has been found that the proposed model in the present study predicts more accurately the thermal efficiency than EES; with an average uncertainty of 0.64% compared to 1.11% for ESS, in the case of Cermet coating. Nevertheless, minor inaccuracy in the estimation of heat losses at higher operation temperatures has been found due to the error propagation in the model. The present work also includes a survey of the design and manufacturing processes of the parabolic trough collector that are of a particular interest for developing this promising technology