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Experimental validation of a solar-chimney power plant model NIMA FATHI, PATRICK WAYNE, IGNACIO TRUEBA MONJE, PETER VOROBIEFF, University of New Mexico — In a solar chimney power plant system (SCPPS), the energy of buoyant hot air is converted to electrical energy. SCPPS includes a collector at ground level covered with a transparent roof. Solar radiation heats the air inside and the ground underneath. There is a tall chimney at the center of the collector, and a turbine located at the base of the chimney. Lack of detailed experimental data for validation is one of the important issues in modeling this type of power plants. We present a small-scale experimental prototype developed to perform validation analysis for modeling and simulation of SCCPS. Detailed velocity measurements are acquired using particle image velocimetry (PIV) at a prescribed Reynolds number. Convection is driven by a temperature-controlled hot plate at the bottom of the prototype. Velocity field data are used to perform validation analysis and measure any mismatch of the experimental results and the CFD data. CFD Code verification is also performed, to assess the uncertainly of the numerical model with respect to our grid and the applied mathematical model. The dimensionless output power of the prototype is calculated and compared with a recent analytical solution and the experimental results.

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