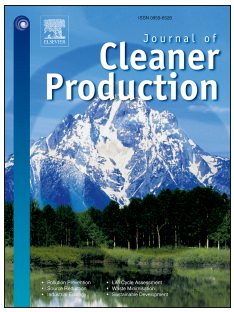
Accepted Manuscript



Influence of thermal energy storage system on flow and performance parameters of solar updraft tower power plant: A three dimensional numerical analysis

Yaswanthkumar Amudam, V.P. Chandramohan

PII: S0959-6526(18)32987-1

DOI: 10.1016/j.jclepro.2018.09.248

Reference: JCLP 14383

To appear in: *Journal of Cleaner Production*

Received Date: 11 July 2018

Revised Date: 29 August 2018

Accepted Date: 28 September 2018

Please cite this article as: Amudam Y, Chandramohan VP, Influence of thermal energy storage system on flow and performance parameters of solar updraft tower power plant: A three dimensional numerical analysis, *Journal of Cleaner Production* (2018), doi: https://doi.org/10.1016/j.jclepro.2018.09.248.

Influence of thermal energy storage system on flow and performance parameters of solar updraft tower power plant: A three dimensional numerical analysis

Yaswanthkumar Amudam, V. P. Chandramohan*

Department of Mechanical Engineering, National Institute of Technology Warangal, Warangal, Telangana State, India - 506 004.

*ORCID ID: 0000-0002-8680-8363, Mail: vpcm80@gmail.com, Phone: 0870 2462314

ABSTRACT

A 3D numerical model is developed for solar updraft tower to identify the effect of thermal energy storage system. Flow parameters such as temperature, velocity, pressure, and density are estimated, analyzed and compared for 2 different models, model - 1 (without thermal energy storage) and model -2 (with thermal storage). The collector diameter of 3.5 m, chimney height of 6 m, chimney diameter of 0.6 m, inlet gap of 0.15 m, slope of the collector 30° are the dimensions considered for model - 1. Model – 2 consists of the same dimensions of model – 1 with additional thermal energy storage system. Sand-rock mixture is considered as energy storage material and it has the thickness of 0.15 m and diameter of 3.5 m. Numerical simulations are performed under steady state condition for both the models at various times (10.00 am, noon, 1.00 pm, 2.00 pm and 4.00 pm) in a day and for model – 2 up to 8.00 pm. Results are compared with experimental and theoretical data from literature and found that the results are matching. Performance parameters such as power output, collector efficiency and overall efficiency of system were estimated and it was found that the values of model – 2 are lower because of heat stored by thermal storage device. Maximum power output for both models (79.92 W for model – 1 and 63.8 W for model – 2) was obtained at 1.00 pm. The addition of thermal storage system enhanced the plant operation time till 8.00 pm.

Keywords: solar updraft tower, thermal energy storage system, performance parameters, numerical heat transfer, maximum power output