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EXPERIMENTAL AND MATHEMATICAL MODELING OF A SOLAR UPDRAFT TOWER POWER PLANT: A CASE STUDY OF EL-BEIDA CITY-LIBYA

AL-Hassan M.Azouz[1*], Tarek A. Hamad[2],Mohammed fawzi[3]
[1]Mechanical Engineering Department, Omar Al-Mukhtar University, El-Beida, Libya
[2,3]Sustainable and Renewable Energy Engineering Department, Omar Al-Mukhtar University, El-Beida, Libya
[1]alhassan.mohammed@omu.edu.ly,[2]Tah5xd@mst.edu ,[3]mohammed.fawzi@omu.edu.ly

ABSTRACT

Libya has about 3400 h of sunshine per year and 2200kWh/m2 annually insolation that is why solar radiation is one of the greatest energy sources in Libya, which can be harvested, the solar updraft tower is a promised technology that has been studied for decades now. This kind solar power plant is heavily dependent on the principle of the buoyancy where is the air inside the collector is heated by solar radiation, the air then becomes less dens than ambient air due to the greenhouse effect, then driven through the turbine to generate electricity. This study is about evaluating this renewable technology in El-Beida city which is located in east of Libya, by performing an experimental small pilot (A small scale prototype of a solar chimney power plant of a chimney height 2.5m and a 2m collector diameter has been built) to estimate power that can be extracted and efficiency of this technology. This paper presents experimental and mathematical modeling of a solar updraft tower in, El-Beida city, focusing on the fluid analysis of heat flowing through the tower in both the theoretical and imperial state. The total power of the radiation intensity of the system and the collector's efficiency (greenhouse), in this study, shows the principle of the working fluids for wind turbines and solar towers was described. Also, the results were presented from model design and simulations method by using Matlab code and characteristic curves.

Keywords: Solar radiation, solar updraft tower, El-Beida City, experimental