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INVESTIGATION OF PERFORMANCE AND PRODUCTION'S POTENTIAL OF LARGE-SCALE SOLAR CHIMNEY POWER PLANT IN THE AREA OF BER'ALGANAM (AZZAWIA-LIBYA)

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ABSTRACT

This paper aims to investigate the performance and production's potential of large scale Solar Chimney Power Plant (SCPP) throughout a year according to measured solar radiation and meteorological data of Ber' Alganam (Azzawia-Libya). A mathematical model was previously developed and experimentally validated to analysis the SCPP. The model gives a comprehensive thermo-hydraulic behavior of the air inside the solar collector as well as through the chimney. The model also estimates the kinetic energy available to operate a wind turbine. Four configurations of large scale SCPP with nominal powers of (5MW, 30MW, 100MW and 200MW) were considered under the Ber' Alganam conditions. The results showed a good agreements between the maximum power recorded annually with the nominal power for each configuration. The average monthly power curve through a year were presented, the annual electrical power generated by the SCPP for four configurations were calculated along with the capacity factors which indicated that the Ber' Alganam area is a suitable location for this type of solar power plants. In addition, the charts indicated that, the overall efficiency is affected by the size (chimney height and collector diameter) and slightly by solar radiation intensity.

Keywords: Renewable energy, Solar energy, Solar chimney, Solar updraft tower, SCPP, Greenhouse, Large-scale solar power plant.