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Comparison of Stationary and Two-Axis Tracking System of 50MW Photovoltaic Power Plant in Al-Kufra, Libya: Landscape Impact and Performance

Authors : Yasser Aldali

Abstract : The scope of this paper is to evaluate and compare the potential of LS-PV (Large Scale Photovoltaic Power Plant) power generation systems in the southern region of Libya at Al-Kufra for both stationary and tracking systems. A Microsoft Excel-VBA program has been developed to compute slope radiation, dew-point, sky temperature, and then cell temperature, maximum power output and module efficiency of the system for stationary system and for tracking system. The results for energy production show that the total energy output is 114GWh/year for stationary system and 148 GWh/year for tracking system. The average module efficiency for the stationary system is 16.6% and 16.2% for the tracking system. The values of electricity generation capacity factor (CF) and solar capacity factor (SCF) for stationary system were found to be 26% and 62.5% respectively and 34% and 82% for tracking system. The GCR (Ground Cover Ratio) for a stationary system is 0.7, which corresponds to a tilt angle of 24°. The GCR for tracking system was found to be 0.12. The estimated ground area needed to build a 50MW PV plant amounts to approx. 0.55 km2 for a stationary PV field constituted by HIT PV arrays and approx. 91 MW/km2. In case of a tracker PV field, the required ground area amounts approx. 2.4k m2 and approx. 20.5 MW/km2.

Keywords : large scale photovoltaic power plant, two-axis tracking system, stationary system, landscape impact
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