

Analysis of the Effect of Soiling on the Performance Ratio of Solar PV Panels

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ABSTRACT

The utilization of Solar Power Plants (PLTS) continues to increase; however, the performance of solar panels can decline due to soiling, which refers to the accumulation of dust on the panel surface that reduces the solar radiation received by the panels and affects the Performance Ratio (PR). This study aims to analyze the influence of environmental factors on soiling levels, determine the effect of dust mass on PR values, and develop recommendations for panel cleaning schedules based on data obtained from the soiling monitoring system. The experiment was conducted on a laboratory-scale DC Solar Power Plant using a 50 Wp solar panel with dust mass variations of 0, 5, 10, and 15 grams. The actual PR values obtained from measurements were compared with the PR value obtained from simulations using PVsyst. The results showed that dust mass was the most dominant factor contributing to the increase in soiling levels, while changes in ambient temperature, humidity, and wind speed during the experiment were relatively small. In addition, panel temperature also contributed to changes in soiling levels due to its influence on the panel surface conditions and the adhesion of dust particles. Increasing the dust mass from 0 to 15 grams resulted in a decrease in the actual PR value from 58.09% to 43.56%, while the PR value obtained from the PVsyst simulation was 38.27%. Based on the economic soiling threshold of 7%, solar panel cleaning is recommended when the soiling level approaches or exceeds this threshold to maintain optimal PLTS performance.

Keywords: Performance Ratio, PLTS, soiling, PVsyst, monitoring system