Review Article

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Review and validation of photovoltaic solar simulation tools/software based on case study

Abstract: Photovoltaic (PV) systems are an excellent solution to meet energy demand and protect the global environment in many cases. With the increasing utilization of the PV system worldwide, there is an increasing need for simulation tools to predict the PV system's performance and profitability. This research includes testing and comparison of PV tools: photovoltaic geographical information system (PVGIS), PVWatts, SolarGIS, RETScreen, BlueSol, PVsyst, HelioScope, PV*SOL, Solarius PV, Solar Pro, PV F-Chart, PolySun, solar advisor model (SAM), and hybrid optimization model for electric renewables (HOMER), based on experimental data obtained from fixed on-grid $2\,kW_p$ PV system in 2019. The PV system is part of a research project related to the examination of the PV system operation in real climatic conditions in Niš. This research investigates the most appropriate PV software for PV systems design by testing the most commonly used PV tools. It was accomplished by comparing experimental data obtained by a $2\,kW_p$ PV system in Niš and estimated data obtained from different PV tools. The study shows that annually, the experimentally measured average daily solar irradiation on the inclined plane was $5{,}270\,Wh/m^2/day$, and the lowest deviation of the simulation results compared to experimental measurements was obtained by SolarPro. Total annual electricity production from the given system was $2455.621\,kW\,h$, and the lowest deviation of the simulation results compared to experimental measurements was obtained by PVGIS. By analyzing and publishing the actual solar irradiation and PV power output data, this study could help researchers to increase the PV systems modeling accuracy.

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