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Forecasting photovoltaic power generation using the temperature-based model – A case study at Vuwani Science Resource Centre

The maximum photovoltaic (PV) power output is not always achieved in real time measurement due to the unsteady weather conditions. Local solar irradiance plays a critical role in the performance of solar panels. Therefore, the site assessment of weather conditions is necessary for a better forecasting of potential PV power output and recommendation of the suitable solar panel. Due to limited weather stations, solar irradiance data is not always available to be used as input in the models to predict power output in different locations. This paper presents two steps approach to be used in the location with insufficient weather parameter data, using temperature data which is easy to measure. The temperature-based model was utilized to estimate solar irradiance to be used in the three PV power output models. The three power models were tested under the standard test condition and compared with the solar panel characteristics provided by the manufacturer. The study is based on the historic temperature data of 2019 collected from the South African University Radiometric Network (SAURAN), USAid Venda station in Vuwani, Limpopo. The results show a good correlation between the measured and calculated solar irradiance as supported by RMSE value of 1.84, MAE value of 1.39, MBE value of 1.29 and R2 statistics value of 0.84, which validated the temperature-based model and made it a reliable input for the three power output models. The average annual power output from the models were respectively, 1016.58 W, 1139.25 W and 910.17 W. The study has proven that the forecast of solar power output can be conducted in areas with limited weather data.

Apply to be considered for a student ; award (Yes / No)?

Yes

Level for award;(Hons, MSc, PhD, N/A)?

PhD

Primary author: Mr MASEVHE, Livhuwani

Co-author: Dr MALUTA, Eric Nnditshedzeni (SAIP)

Presenter: Mr MASEVHE, Livhuwani

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