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Wind effect on PV module temperature: Analysis of different techniques for an accurate estimation.

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In this abstract a study on the influence of wind to model the PV module temperature is presented. This study is carried out in the framework of the PV-Alps INTERREG project in which the potential of different photovoltaic technologies is analysed for alpine regions. The PV module temperature depends on different parameters, such as ambient temperature, irradiance, wind speed and PV technology [1]. In most models, a very simple approach is used, where the PV module temperature is calculated from NOCT (nominal operating cell temperature), ambient temperature and irradiance alone [2].

In this study the influence of wind speed on the PV module temperature was investigated. First, different approaches suggested by various authors were tested [1], [2], [3], [4], [5]. For our analysis, temperature, irradiance and wind data from a PV test facility at the airport Bolzano (South Tyrol, Italy) from the EURAC Institute of Renewable Energies were used.

The PV module temperature was calculated with different models and compared to the measured PV module temperature at the single panels. The best results were achieved with the approach suggested by Skoplaki et al. [1]. Preliminary results indicate that for all PV technologies which were tested (monocrystalline, amorphous, microcrystalline and polycrystalline silicon and cadmium telluride), modelled and measured PV module temperatures show a higher agreement (RMSE about 3-4 K) compared to standard approaches in which wind is not considered.

For further investigation the in-situ measured wind velocities were replaced with wind data from numerical weather forecast models (ECMWF, reanalysis fields). Our results show that the PV module temperature calculated with wind data from ECMWF is still in very good agreement with the measured one ($R^2 > 0.9$ for all technologies). Compared to the previous analysis, we find comparable mean values and an increasing standard deviation. These results open a promising approach for PV module temperature estimation using meteorological parameters.

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