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Assessment of the energy yield of thin-film solar modules in various climate conditions

Energy performance of the PV modules depend significantly on the outdoor weather conditions. In the project PVKLIMA energy yield measurements of thin-film and crystalline PV modules are carried out in the regions with different climate: temperate, Mediterranean, hot, tropical and desert climates.

First, energy-meteorology evaluations of the measurements are presented. The seasonal effects, spectral and temperature behaviour of the modules are investigated.

Modeling of the PV module temperature is the next step in the energy rating procedure. Different temperature models were studied and verified with the measurements for polycrystalline silicon, cadmium telluride and copper indium selenide technologies. One year measurements provided by TÜV Rheinland contain 10 minutes values of module plane irradiance, ambient and module temperature, wind speed near to the module for the PVKLIMA test sites Cologne (Germany), Ancona (Italy) and Arizona (USA).

Since the measurements of meteorological data for a given location are not always available different sources of data can be used. We consider ERA-Interim reanalysis database as a source of ambient temperature and wind speed and study the accuracy of the module temperature predictions in that case. The solar irradiance will later be retrieved from Meteosat Satellites.

In conclusion, we consider the Karmalkar Haneefa Model, which is a simple four parameters model for fitting IV curves and discuss its application for the PV module performance estimation.

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