

Analysis of Solar Radiation Models and Three-Dimensional Modelling Of Irradiance

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ABSTRACT

Modelling and simulation of solar energy systems require reliable and comprehensive solar radiation data and models. Solar PV systems, in particular, require hourly solar radiation models. The intermittent nature of solar radiation, and the uncorrelated behaviour of solar resource availability to the energy use, makes techno-economic planning, designing and operation assessment of solar energy conversion systems challenging. The paper explores and analyses different modelling techniques for predicting hourly solar data. The models are based on the assumption of clear sky without any cloud cover, and are compared and validated using measured data from a site in Namibia. The models analysed have unique similarities and differences. The Collares-Pereira and Rabl model (CPR) closely mimics daily variations. The results are presented as two- and three-dimensional graphs depicting seasonal variations in solar radiation. In order to show variations in radiation seasonally, daily and regionally (using latitude), three-dimension graphs are presented. This type of modelling can easily be adopted by researchers, academics and planners, to have a clear understanding of the variations in solar radiations. For planning purposes modelling of solar radiation can be used to carry out preliminary studies especially in areas with limited access to reliable solar radiation data.

Key words: Solar Radiation; Modelling; Simulation; Three-dimension

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