Abstract

The performance of a photovoltaic (PV) panel is primarily dependent on the solar radiation received. Thus the position and angle of tilt of a PV panel are important factors in PV system design. The amount of energy captured from the sun depends on the tilt angle of the solar panels. If solar panels are mounted horizontally or vertically, lesser energy is captured than if the panels face due south in the Northern Hemisphere and due north in the Southern Hemisphere and are tilted towards the sun. This paper examines the factors affecting tilt angle for the solar panel and aims to select an appropriate theoretical model for determining the optimal tilt angle for solar PV panels placed at Jodhpur, Rajasthan. Four isotropic models and four anisotropic models have been considered to identify the best model for the given
conditions. The selected model has been validated by applying it for finding out the yearly optimum tilt angle for Jodhpur and comparing the results with those obtained from the data collected at the solar panels installed at IIT Rajasthan. It is found that Liu and Jordan model gives results which are quite close to the results of the data measured at the solar panel installed at IIT Rajasthan. This model is also used for determination of monthly average and seasonal average of optimal tilt angle. It has been concluded that the average optimum tilt angle at Jodhpur for winter months is 47.60 and for summer months 120. Further, in the monthly adjusted system, the loss of energy is less than 1% (0.97) if the angle of tilt is adjusted seasonally. It is hence suggested that seasonally adjusted tilt angle should be preferred. However, yearly average fixed tilt can be used in many general applications (e.g. domestic water heating) in order to keep the manufacturing and installation costs of collectors low. The loss in collected radiation for the yearly average fixed angle is around 12.7% as compared with the optimum tilt at Jodhpur. Hence, for attaining higher efficiency, the collector should be designed such that the angle of tilt can easily be changed at least on a seasonal basis, if not monthly.

References

- Koronakis P., "On the Choice of The Angle of Tilt for South Facing Solar Collectors"
in the Athens Basin Area

- Optimum tilt angle calculator software supplied by NREL. [Internet]rredc.nrel.gov/solar/calculators/pvwatts/version1

Index Terms

- Computer Science
- Power Systems

Keywords

- Tilt Angle
- Solar Panel
- Diffused Radiation Models