Journal of Fundamentals of Renewable Energy and Applications

Kambezidis, J Fundam Renewable Energy App 2016, 6:2
DOI: 10.4172/2090-4541.1000e106

Editorial Open Access

Current Trends in Solar Radiation Modeling: The Paradigm of MRM

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Rec date: Jan 25, 2016, **Acc date:** Jan 27, 2016, **Pub date:** Jan 29, 2016

Editorial

Solar power systems have been at the forefront of the global energy market for at least one decade. In the meantime, the world has realised that the only environmentally-friendly option for power generation is the implementation of Renewable Energy Sources. In this context, the solar power systems have shown remarkable market penetration. At the same time, a rapid increase in installed units of photovoltaic (PV) systems has been recorded worldwide. Figure 1 gives a clear picture of the shares. Prior to PV installations, it is obvious that accurate solar radiation measurements are needed.

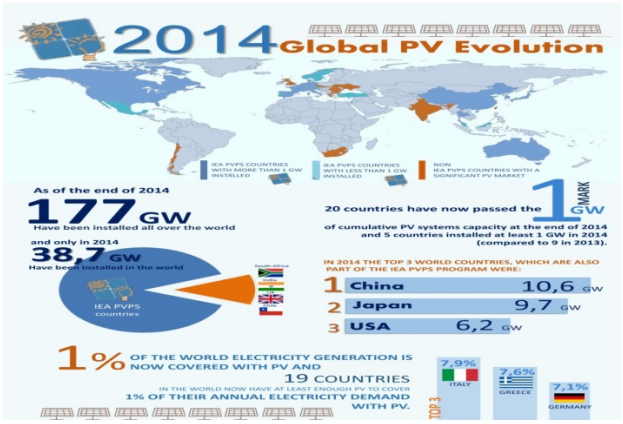

Figure 1: Global PV evolution at the end of 2014 [1].

In recent years, solar radiation modelling that utilises existing climatic parameters, such as sunshine duration or cloud cover, relative humidity, air temperature etc., has shown remarkable progress. It is generally accepted that the use of models for solar radiation prediction, instead of using scattered ground-based measurements, is essential during solar energy systems design, because in most cases the low density and the limited number of solar radiation measuring stations cannot describe the required variability of the climatic parameters involved [1,2].

Several solar radiation models have appeared globally since the middle of the 20th century in order to generate solar radiation on horizontal plane, mostly under clear-sky conditions [3]. For example, the US National Solar Radiation Data Base provides hourly radiation data and Typical Meteorological Years for 239 US regions, with more than 90% of those data coming from appropriate modelling [4]. Also, the European Solar Radiation Atlas (ESRA) model is used for providing topography-based maps of solar irradiance in Europe and bordering countries [5].

Among the solar radiation codes developed over the past 40 years there exists a broadband model, which has been developed in Greece in the late 80's by the Atmospheric Research Team at the National Observatory of Athens; the code estimates solar radiation on horizontal surface and is called "Meteorological Radiation Model" or briefly MRM. Since its development, consecutive versions (latest is version 6) of the model have been released with their full description given in a series of publications [6,7]. Applications of MRM may be found in a variety of solar resource assessment studies as well as in solar irradiance forecasting [8,9]. The main advantage of MRM against other models is its simplicity in the input data needed (i.e. four measured variables, namely, air temperature, relative humidity, barometric pressure and sunshine duration) at the location of the application. MRM can be applied worldwide. It has been tested by various researchers [3,10] and credits have been given for its accuracy. This accuracy is shown in Figure 2, where MRM is estimating quite well the global and diffuse horizontal irradiance variations during an almost complete sun-eclipse event over Athens on March 29, 2006.

MRM is provided free of charge to any interested user after relevant request to Dr. Harry Kambezidis.

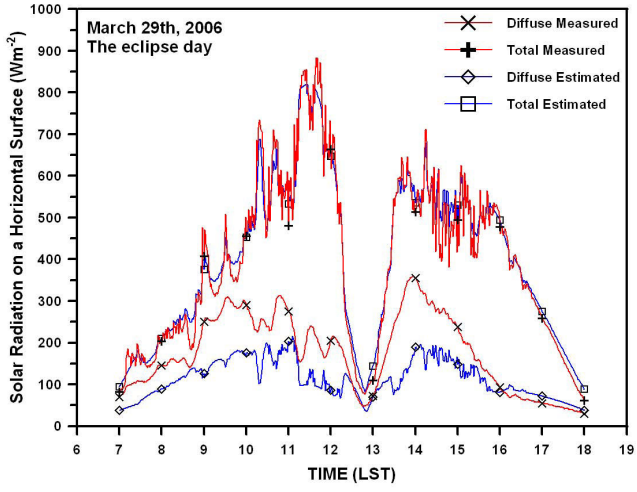

Figure 2: Comparison between measured total (global)/diffuse solar irradiances and estimated from MRM during the eclipse of March 29, 2006 over Athens, Greece [7].

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