frontiers | Frontiers in Energy Research

TYPE Editorial
PUBLISHED 26 December 2022
DOI 10.3389/fenrg.2022.1115096

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to
Solar Energy,
a section of the journal
Frontiers in Energy Research

RECEIVED 03 December 2022
ACCEPTED 16 December 2022
PUBLISHED 26 December 2022

CITATION
Cotfas DT, Marzband M, Cotfas PA,
Siroux M and Sera D (2022), Editorial:
Forecasting solar radiation, photovoltaic
power and thermal energy
production applications.
Front. Energy Res. 10:1115096.
doi: 10.3389/fenrg.2022.1115096

Editorial: Forecasting solar radiation, photovoltaic power and thermal energy production applications

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KEYWORDS

forecasting, solar radiation, photovoltaic, parameters, algorithm

Editorial on the Research Topic
Forecasting solar radiation, photovoltaic power and thermal energy production aplications."

Forecasting energy production of photovoltaic systems is a hot Research Topic nowadays, when energy prices are one of the highest in history. The forecast of the photovoltaic power production can be on the long term from 1 month to 1 year, on medium-term from 1 week to 1 month, on short-term from 6 h to 72 h, and on very short-term from 15 min to 6 h.

It is crucial to forecast solar radiation and photovoltaic power production so as to control and manage the electrical stand-alone systems, smartgrids and grids, to ensure power demand can be met (Kumar et al., 2020). The forecast can be made using the following methods: numerical weather prediction models (NWP), physical techniques, linear statistical models, and machine learning techniques (Ramirez-Vergara et al., 2021).

The Research Topic aims to cover some of the forecast problems. It has eight accepted papers, that cover the following Research Topic: methods to maximize the output power of the photovoltaic system, solar radiation forecast, and power generation prediction.

There are several methods to maximize the energy output of the photovoltaic systems. Guo et al. use artificial intelligence to find the maximum power point (MPP) under partial shading conditions. They designed a fuzzy adaptive PSO-based MPP tracker.

The solar radiation is forecasted using several methods. Mohanty et al. used an adaptive neuro-fuzzy inference system, for different locations, which has three input parameters, such as: the duration of the sunshine, temperature, and humidity, and clearness index as the output parameter. Silva et al. used linear modeling ARX and ARMAX to forecast solar radiation with very good accuracy for the Brazilian locations. Belmahdi et al. predicted the daily global solar radiation for 25 different Moroccan cities by using feedforward neural backpropagation network method, FFNN-BP. The input parameters are solar radiation at the top outside atmosphere, clearness index, solar declination, latitude, longitude, altitude, day number, the length of the day, minimum and maximum temperature, mean temperature, temperature

difference, ratio temperature, average relative humidity, and average wind speed. For different locations, different combinations of these parameters are used.

Yang et al. use the improved random forest method to predict the power generated by the photovoltaic system in ultra-short-term. This method improves the results for morning and evening prediction in comparison with other methods. Yu et al. propose a new method to predict the power generated by photovoltaic systems, which is a hybridization between the convolutional long short-term memory network model and the adaptive mutation particle swarm optimization. Nunes et al. study the influence of the partial shading on the photovoltaic power generation and introduced the hill climbing neural network algorithm to accurately extract the parameters of the photovoltaic module, for both models single and double diode, that allow a very acurrate prediction of the power generated in partial shading conditions. Using the approximate entropy algoritm the predictibility of the power generated is analysed. Yang et al. proposed a predictability coefficient. It can describe quantitatively the predictability of the power generated by photovoltaic systems.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

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