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Section

# B1: Solar Energy and Photovoltaic Systems

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**Section Editor-in-Chief**
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## About the section *B1: Solar Energy and Photovoltaic Systems*

The use of solar energy is expected to increase around the world in the coming years. Particularly at middle and at low latitudes, it will be the main source of energy supporting the economy after global and local crises. Due in part to its reduced past environmental impact, solar energy will be crucial to the green production of industrial gases, a key factor in efficient, green, distributed energy storage. Solar–thermal concentration and photovoltaic plants will ensure distributed electrical energy production from very large scale to small local generation. The new industrial paradigms and increasing appeal of electrical mobility will require more green energy from the sun. This revolution needs to be pushed by high quality research results, both from academia and industrial R&D departments.

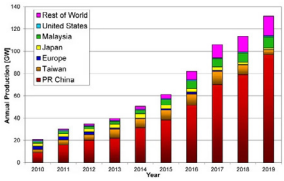
In this section, we aim to collect original and review papers reporting the latest advances in the broad field of solar and photovoltaic systems, including power generation and storage. We will focus on both established technologies applied in the real-world and prototype systems demonstrated on a laboratory scale. The demonstration of new material concepts and their application in devices will be of particular relevance as a way to provide the community with new potential solutions for future applications.

## Content Highlights

DOI:10.3390/en13040930

**Snapshot of Photovoltaics—February 2020**

*Author: Arnulf Jäger-Waldau*




Abstract: Since the demonstration of the first modern silicon solar cells at Bell Labs in 1954, it took 58 years until the cumulative installed photovoltaic electricity generation capacity had reached 100 GW by the end of 2012. Then, it took another five years to reach an annual installation capacity of over 100 GW in 2017 and close to 120 GW in 2019. As a consequence, the total world-wide installed photovoltaic electricity generation capacity exceeded 635 GW at the end of 2019. Although it witnessed a 20% and 25% decrease in annual installations in 2018 and 2019, respectively, China was again the largest market with 30 GW of annual installations. The number of countries in the club with more than 1 GW annually has increased to 18 countries in 2019. The use of local battery storage systems in solar farms as well as decentralized photovoltaic electricity generation systems combined has again increased, due to the falling storage system costs.

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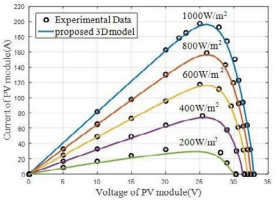
DOI:10.3390/en13020497

**Parameter Estimation of Three Diode Photovoltaic Model Using Grasshopper Optimization Algorithm**

*Authors: Omnia S. Elazab, Hany M. Hasanien, Ibrahim Alsaidan, Almoataz Y. Abdelaziz and S. M. Muyeen*




Abstract: While addressing the issue of improving the performance of Photovoltaic (PV) systems, the simulation results are highly influenced by the PV model accuracy. Building the PV module mathematical model is based on its I-V characteristic, which is a highly nonlinear relationship. All the PV cells' data sheets do not provide full information about their parameters. This leads to a nonlinear mathematical model with several unknown parameters. This paper proposes a new application of the Grasshopper Optimization Algorithm (GOA) for parameter extraction of the three-diode PV model of a PV module. Two commercial PV modules, Kyocera KC200GT and Solarex MSX-60 PV cells are utilized in examining the GOA-based PV model. The simulation results are executed under various temperatures and irradiations. The proposed PV model is evaluated by comparing its results with the experimental results of these commercial PV modules. The efficiency of the GOA-based PV model is tested by making a fair comparison among its numerical results and other optimization method-based PV models. With the GOA, a precise three-diode PV model shall be established.

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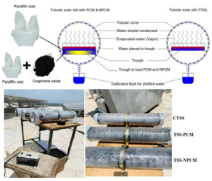
DOI:10.3390/en13153989

**Comparative Study of Tubular Solar Stills with Phase Change Material and Nano-Enhanced Phase Change Material**

*Authors: M. Mohamed Thalib, Athikesavan Muthu Manokar, Fadl A. Essa, N. Vasimalai, Ravishankar Sathyamurthy and Fausto Pedro Garcia Marquez*




Abstract: This study is intended to investigate and analyze the operational performances of the Conventional Tubular Solar Still (CTSS), Tubular Solar Still with Phase Change Material (TSS-PCM) and Tubular Solar Still with Nano Phase Change Material (TSS-NPCM). Paraffin wax and graphene plusparaffin wax were used in the CTSS to obtain the modified solar still models. The experimental study was carried out in the three stills to observe the operational parameters at a water depth of 1 cm. The experiment revealed that TSS-NPCM showed the best performance and the highest yield in comparison to other stills. The distillate yield from the CTSS, TSS-PCM and TSS-NPCM was noted to be 4.3, 6.0 and 7.9 kg, respectively, the daily energy efficiency of the stills was observed to be 31%, 46% and 59%, respectively, and the daily exergy efficiency of the stills was recorded to be 1.67%, 2.20% and 3.75%, respectively. As the performance of the TSS-NPCM was enhanced, the cost of freshwater yield obtained was also low in contrast to the other two types of stills.

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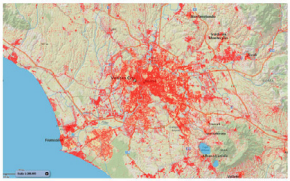
DOI:10.3390/en13020417

**Solar Energy Data Analytics: PV Deployment and Land Use**

*Authors: Francesco Mancini and Benedetto Nastasi*



Abstract: EU targets for sustainable development call for strong changes in the current energy systems as well as committed protection of environmental resources. This target conflicts if a policy is not going to promote the compatible solutions to both the issues. This is the case of the additional renewable energy sources to be exploited for increasing the share in the electricity mix and in the gross final energy consumption. Solar energy is, currently, the cheapest solution in Southern European Countries, like Italy. In this paper, thanks to the availability of three open databases provided by National Institutions, the authors compared the historic trends and policy scenarios for soil consumption, electricity consumption, and renewable electricity production to check correlations. The provincial scale was chosen as resolution of the analysis. The deviations from the policy scenarios was then addressed to identify the demand for policy recommendations and pathways to promote in order to achieve the target for renewable electricity share as well as the reduction in soli consumption trend in 2030. The role of renewables integrated in the existing contexts, such as building integrated photovoltaics, is considered a key driver for solving this issue.

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## Special Issues Open for Submission

**Control of Photovoltaic Converters**
Guest Editors: Prof. Dr. Francisco de Assis dos Santos Neves, Prof. Dr. Rafael Cavalcanti Neto and Prof. Dr. Fabrício Bradaschia
Deadline: **20 April 2022**

**Perovskite Solar Cells and Its Materials: Analysis and Characterization**
Guest Editor: Dr. Juan Jesus Gallardo Bernal
Deadline: **30 April 2022**

**Advances in Efficient Organic Solar Cells**
Guest Editors: Dr. Tanya Kumari, Prof. Dr. Morten Madsen and Dr. Vida Engmann
Deadline: **20 May 2022**

**Photovoltaic Technologies and System Integration**
Guest Editor: Dr. Emeka H. Amalu
Deadline: **1 June 2022**

**Thermal Energy Storage in Solar Power Plants**
Guest Editor: Dr. Babkir Ali
Deadline: **15 June 2022**

**Applications of Solar Cells and Photovoltaic Systems**
Guest Editor: Dr. Vijayakumar Elayappan
Deadline: **1 August 2022**

**Hybrid Solar Photovoltaic/Thermal Systems**
Guest Editors: Prof. Dr. Rodrigo Escobar and Prof. Dr. José Cardemil
Deadline: **15 August 2022**

**Advances in Solar Irradiance Forecasting**
Guest Editor: Dr. Laurent Linguet, Dr. Zermani Sara
Deadline: **31 August 2022**

**Advances in Hot Carrier Solar Cells**
Guest Editor: Dr. Mingjie Li
Deadline: **30 September 2022**

**Application of Nanotechnology in Photovoltaic Systems**
Guest Editors: Prof. Dr. João Paulo N. Torres and Dr. Ricardo Lameirinhas
Deadline: **31 December 2022**

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