Special Issue List in Section

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Deadline: **7 September 2020**

Recent Advances in Hybrid Photovoltaic/Thermal (PV/T) Solar Systems
Guest Editor: Prof. Manolis Souliotis
Deadline: **30 September 2020**

Photovoltaic Performance of Dye-Sensitized and Perovskite Solar Cells
Guest Editors: Dr. JongChul Lim and Dr. Min Kim
Deadline: **30 September 2020**

Emerging Converter Topologies and Control for Grid Connected Photovoltaic Systems
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Guest Editors: Prof. Dr. Eduardo F. Fernández, Prof. Dr. Pedro Perez-Higueras and Dr. Florencia Almonacid Cruz
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Guest Editors: Prof. Dr. Daniel Tudor Cotfas and Prof. Dr. Petru Adrian Cotfas
Deadline: **20 October 2020**

Methods, Algorithms and Circuits for Photovoltaic Systems Diagnosis and Control
Guest Editors: Prof. Dr. Giovanni Spagnuolo and Dr. Mattia Ricco
Deadline: **31 October 2020**

Advances in Concentrator Photovoltaics and Solar Cells
Guest Editor: Prof. Dr. Donato Vincenzi
Deadline: **31 October 2020**

Impact of Interconnected PV Systems on Power Quality of Distribution Networks
Guest Editors: Prof. Dr. Sonia Ferreira Pinto, Dr. Cedric Caruana, Dr. Grazia Barchi, Dr. John Licari and Dr. Jonathan Leloux
Deadline: **31 October 2020**

Perovskite Solar Cells
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Scientific and Technological Advances in Photovoltaic Solar Energy Conversion
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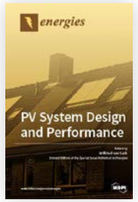

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Section

Solar Energy and Photovoltaic Systems

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Section Information

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.

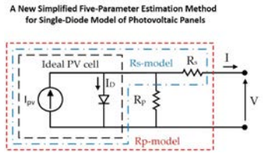
Feature Papers

DOI: 10.3390/en12224271

A New Simplified Five-Parameter Estimation Method for Single-Diode Model of Photovoltaic Panels

Vincenzo Stornelli, Mirco Muttillo, Tullio de Rubeis and Iole Nardi

Abstract: This work proposes a new simplified five-parameter estimation method for a single-diode model of photovoltaic panels. The method, based on an iterative algorithm, is able to estimate the parameter of the electrical single-diode model from the panel's datasheet. Two iterative steps are used to estimate the five parameters starting from data provided by the manufacturer (nameplate values or I–V curves). The first step permits finding the optimal value of the diode ideality factor A, and the second step allows the calculation of the R_p value to improve the accuracy. A model that takes into account variations in temperature and solar irradiance has been used to validate the behavior of the output parameters. Compared to other estimation work, the proposed method shows the best result in the standard test condition (STC) and with a variable solar irradiance. Indeed, the optimization of the A, R_s, and R_p parameters allows guaranteeing the minimum error between I–V curves obtained from method and datasheet.

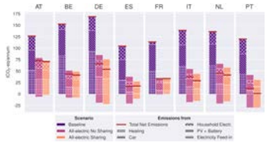


DOI: 10.3390/en12234440

Comparison of the Greenhouse Gas Emission Reduction Potential of Energy Communities

Wouter Schram, Atse Louwen, Ioannis Lampropoulos and Wilfried van Sark

Abstract: In this research, the greenhouse gas (GHG) emission reduction potentials of electric vehicles, heat pumps, photovoltaic (PV) systems and batteries were determined in eight different countries: Austria, Belgium, France, Germany, Italy, the Netherlands, Portugal and Spain. Also, the difference between using prosuming electricity as a community (i.e., energy sharing) and prosuming it as an individual household was calculated. Results show that all investigated technologies have substantial GHG emission reduction potential. A strong moderating factor is the existing electricity generation mix of a country: the GHG emission reduction potential is highest in countries that currently have high hourly emission factors. GHG emission reduction potentials are highest in southern Europe (Portugal, Spain, Italy) and lowest in countries with a high share of nuclear energy (Belgium, France). Hence, from a European GHG emission reduction perspective, it has most impact to install PV in countries that currently have a fossil-fueled electricity mix and/or have high solar irradiation. Lastly, we have seen that energy sharing leads to an increased GHG emission reduction potential in all countries, because it leads to higher PV capacities.



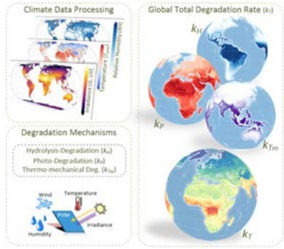
Feature Papers

DOI: 10.3390/en12244749

Global Climate Data Processing and Mapping of Degradation Mechanisms and Degradation Rates of PV Modules

Julián Ascencio-Vásquez, Ismail Kaaya, Kristijan Brecl, Karl-Anders Weiss and Marko Topič

Abstract: Photovoltaic (PV) systems are the cheapest source of electricity in sunny locations and nearly all European countries. However, the fast deployment of PV systems around the world is bringing uncertainty to the PV community in terms of the reliability and long-term performance of PV modules under different climatic stresses, such as irradiation, temperature changes, and humidity. Methodologies and models to estimate the annual degradation rates of PV modules have been studied in the past, yet, an evaluation of the issue at global scale has not been addressed so far. Hereby, we process the ERA5 climate re-analysis dataset to extract and model the climatic stresses necessary for the calculation of degradation rates. These stresses are then applied to evaluate three degradation mechanisms (hydrolysis-degradation, thermomechanical-degradation, and photo- degradation) and the total degradation rate of PV modules due to the combination of temperature, humidity, and ultraviolet irradiation. Further on, spatial distribution of the degradation rates worldwide is computed and discussed proving direct correlation with the Köppen-Geiger-Photovoltaic climate zones, showing that the typical value considered for the degradation rate on PV design and manufacturer warranties (i.e., 0.5%/a) can vary ± 0.3%/a in the temperate zones of Europe and rise up to 1.5%/a globally. The mapping of degradation mechanisms and total degradation rates is provided for a monocrystalline silicon PV module. Additionally, we analyze the temporal evolution of degradation rates, where a global degradation rate is introduced and its dependence on global ambient temperature demonstrated. Finally, the categorization of degradation rates is made for Europe and worldwide to facilitate the understanding of the climatic stresses.



DOI: 10.3390/en12193798

Large Photovoltaic Power Plants Integration: A Review of Challenges and Solutions

Nouha Mansouri, Abderezak Lashab, Dezso Sera, Josep M. Guerrero and Adnen Cherif

Abstract: Renewable energy systems (RESs), such as photovoltaic (PV) systems, are providing increasingly larger shares of power generation. PV systems are the fastest growing generation technology today with almost ~30% increase since 2015 reaching 509.3 GW_p worldwide capacity by the end of 2018 and predicted to reach 1000 GW_p by 2022. Due to the fluctuating and intermittent nature of PV systems, their large-scale integration into the grid poses momentous challenges. This paper provides a review of the technical challenges, such as frequency disturbances and voltage limit violation, related to the stability issues due to the large-scale and intensive PV system penetration into the power network. Possible solutions that mitigate the effect of large-scale PV system integration on the grid are also reviewed. Finally, power system stability when faults occur are outlined as well as their respective achievable solutions.