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Section

Electrical Engineering

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Section Information:

We are living nowadays an Energy transition. We are going more electrical than ever before in transportation: electrical vehicles and ships, electrical motors are every were. Back home, more electronics, electrical kitchens and electronic controlled devices are more and more present. In some houses is not rare to see photovoltaic systems, home batteries, electrical vehicle chargers, electrical grass cutting machines, even equipped with small batteries. It is clear that energy is going more to be electrical and this is a great chance to go more toward renewable energies. Photovoltaics, wind power generation, and other renewables are going to play an unprecedented role in the way that we generate, store and consume energy. This is a chance of the change in a sustainable world that has only one possible direction, with new technologies and ideas.

This section is devoted to present the new technologies, trends and breakthroughs to promote more renewable energies for a future 100% renewable energy reality. This section, focuses on original and new research results regarding electrical power and energy technologies, as well as in diverse applications. Thus, manuscripts on planning, design, implementation, theoretical studies, economical and viability studies, as well as on their application to traditional as well as novel scenarios are solicited. Submissions addressing reviews and surveys will also be welcome.

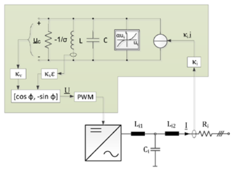
Section Electrical Engineering

Featured Papers

DOI: 10.3390/en13102589

Overview on Grid-Forming Inverter Control Methods

Authors: Peter Unruh, Maria Nuschke, Philipp Strauß and Friedrich Welck

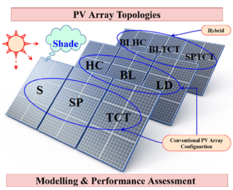


Abstract: In this paper, different control approaches for grid-forming inverters are discussed and compared with the grid-forming properties of synchronous machines. Grid-forming inverters are able to operate AC grids with or without rotating machines. In the past, they have been successfully deployed in inverter dominated island grids or in uninterruptable power supply (UPS) systems. It is expected that with increasing shares of inverter-based electrical power generation, grid-forming inverters will also become relevant for interconnected power systems. In contrast to conventional current-controlled inverters, grid-forming inverters do not immediately follow the grid voltage. They form voltage phasors that have an inertial behavior. In consequence, they can inherently deliver momentary reserve and increase power grid resilience.

DOI: 10.3390/en13123216

Evaluation of Mathematical Model to Characterize the Performance of Conventional and Hybrid PV Array Topologies under Static and Dynamic Shading Patterns

Authors: Manoharan Premkumar, Umashankar Subramaniam,
Thanikanti Sudhakar Babu, Rajvikram Madurai Elavarasan and Lucian Mihet-Popa

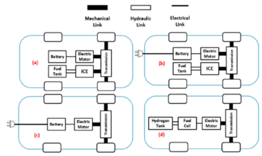


Abstract: The analysis and the assessment of interconnected photovoltaic (PV) modules under different shading conditions and various shading patterns are presented in this paper. The partial shading conditions (PSCs) due to the various factors reduce the power output of PV arrays, and its characteristics have multiple peaks due to the mismatching losses between PV panels. The principal objective of this paper is to model, analyze, simulate and evaluate the performance of PV array topologies such as series-parallel (SP), honey-comb (HC), total-cross-tied (TCT), ladder (LD) and bridge-linked (BL) under different shading patterns to produce the maximum power by reducing the mismatching losses (MLs). Along with the conventional PV array topologies, this paper also discusses the hybrid PV array topologies such as bridge-linked honey-comb (BLHC), bridge-linked total-cross-tied (BLTCT) and series-parallel total-cross-tied (SPTCT). The performance analysis of the traditional PV array topologies along with the hybrid topologies is carried out during static and dynamic shading patterns by comparing the various parameters such as the global peak (GP), local peaks (LPs), corresponding voltage and current at GP and LPs, fill factor (FF) and ML. In addition, the voltage and current equations of the HC configuration under two shading conditions are derived, which represents one of the novelties of this paper. The various parameters of the SPR-200-BLK-U PV module are used for PV modeling and simulation in MATLAB/Simulink software. Thus, the obtained results provide useful information to the researchers for healthy operation and power maximization of PV systems.

DOI: 10.3390/en13184675

Review of Positive and Negative Impacts of Electric Vehicles Charging on Electric Power Systems

Authors: Morsy Nour, José Pablo Chaves-Ávila, Gaber Magdy and Álvaro Sánchez-Miralles

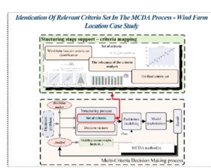


Abstract: There is a continuous and fast increase in electric vehicles (EVs) adoption in many countries due to the reduction of EVs prices, governments' incentives and subsidies on EVs, the need for energy independence, and environmental issues. It is expected that EVs will dominate the private cars market in the coming years. These EVs charge their batteries from the power grid and may cause severe effects if not managed properly. On the other hand, they can provide many benefits to the power grid and get revenues for EV owners if managed properly. The main contribution of the article is to provide a review of potential negative impacts of EVs charging on electric power systems mainly due to uncontrolled charging and how through controlled charging and discharging those impacts can be reduced and become even positive impacts. The impacts of uncontrolled EVs charging on the increase of peak demand, voltage deviation from the acceptable limits, phase unbalance due to the single-phase chargers, harmonics distortion, overloading of the power system equipment, and increase of power losses are presented. Furthermore, a review of the positive impacts of controlled EVs charging and discharging, and the electrical services that it can provide like frequency regulation, voltage regulation and reactive power compensation, congestion management, and improving power quality are presented. Moreover, a few promising research topics that need more investigation in future research are briefly discussed. Furthermore, the concepts and general background of EVs, EVs market, EV charging technology, the charging methods are presented.

DOI: 10.3390/en13246548

Identification of Relevant Criteria Set in the MCDA Process—Wind Farm Location Case Study

Authors: Bartłomiej Kizielewicz, Jarosław Wątróbski and Wojciech Sałabun



Abstract: The paper undertakes the problem of proper structuring of multi-criteria decision support models. To achieve that, a methodological framework is proposed. The authors' framework is the basis for the relevance analysis of individual criteria in any considered decision model. The formal foundations of the authors' approach provide a reference set of Multi-Criteria Decision Analysis (MCDA) methods (TOPSIS, VIKOR, COMET) along with their similarity coefficients (Spearman correlation coefficients and WS coefficient). In the empirical research, a practical MCDA-based wind farm location problem was studied. Reference rankings of the decision variants were obtained, followed by a set of rankings in which particular criteria were excluded. This was the basis for testing the similarity of the obtained solutions sets, as well as for recommendations in terms of both indicating the high significance and the possible elimination of individual criteria in the original model. When carrying out the analyzes, both the positions in the final rankings, as well as the corresponding values of utility functions of the decision variants were studied.

Selected Special Issues list in Section

Research on Wireless Power Transfer System
Guest Editor: Prof. Dr. ByoungHee Lee
Deadline: **20 October 2022**

Energy Optimization of Process Systems Engineering
Guest Editors: Prof. Dr. Bingjian Zhang and Dr. Chang He
Deadline: **10 October 2022**

Design, Analysis and Control of Permanent Magnet Machines
Guest Editors: Prof. Dr. Yongxiang Xu and Dr. Guodong Yu
Deadline: **31 October 2022**

Research on the Optimal Selection of Electromechanical Drives
Guest Editors: Dr. Dominik Wilczyński and Dr. Radosław Pytliński
Deadline: **20 November 2022**

Dynamics, Control and Optimization of Power Systems for Renewable Integration and Decarbonization
Guest Editors: Dr. Yichen Zhang and Dr. Aleksandar Dimitrovsk and Dr. Yan Li
Deadline: **25 November 2022**

Power Converter Control Applications in Low-Inertia Power Systems
Guest Editors: Dr. Elyas Rakhshani and Prof. Peter Palensky and Dr. Aleksandra Lekić
Deadline: **30 November 2022**

Electrical Systems for Marine Renewable Energy Applications
Guest Editors: Dr. Cecilia Boström and Prof. Dr. Irina Temiz
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Development of Voltage and Current Transformers in Power System
Guest Editor: Prof. Dr. Michał Kaczmarek
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Energy Efficiency Improvement of Electric Machines without Rare-Earth Magnets
Guest Editors: Dr. Vladimir Prakht and Dr. Mohamed N. Ibrahim and Dr. Vadim Kazakbaev
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Power Transmission and Distribution Equipment and Systems
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