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Editorial

Power Systems' Connectivity and Resiliency: Modeling, Simulation and Analysis

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Over the last decade, online data acquisition and processing of power systems' parameters led to significant improvements in power systems' operability, control and reliability. The widespread use of renewable energy sources and the development of microgrids have created problems in managing all of the parameters of a power system. Concurrently, vulnerabilities arise due to both new methods of remote access and reduced redundancy. For this reason, almost all the hardware and software components of a power system are potentially critical infrastructures, exposed to physical or informatics events that either naturally occur or are intentionally provoked. Critical infrastructure includes the energy system (electricity, oil or gas), the transportation system, the water supply and energy distribution. Furthermore, most national power systems are interconnected, and hence, achieving the security and resilience of these interdependent critical structures requires the identification of a multitude of risks and their reduction to an acceptable level to minimally impact citizens' quality of life.

The security of power systems means physical security of a power system against calamities or natural disasters and physical attacks carried out by individuals or organizations with the intent to destroy its key points and disrupt the system, as well as cybernetic security. Although they are different, these two areas—physical security and cyber security—are interconnected, with complex vulnerabilities. Therefore, the complex analysis, modeling and simulation of power systems' resiliency have recently become strategically important. However, a robust power system can be considered to have a good resiliency factor if it has strong resistance to disturbances and the ability to quickly recover after an outage.

This Special Issue of *Energies*, entitled "Power Systems' Connectivity and Resiliency: Modeling, Simulation and Analysis" contains five successful submitted articles.

Topics of interest for publication included, but were not limited to:

- Power system modeling, simulation and analysis;
- The modeling and optimization of power systems operations;
- Applications of ICT, IoT and/or AI for power systems;
- Modeling, simulation and design of resilient sensors networks;
- The continuity of electricity supply, reliability and resilience—modeling and analysis;
- The modeling, simulation and analysis of resiliency for microgrids;
- Power system monitoring, protection and control;
- Resilience assessment of power systems with distribution generation;
- Connectivity technologies in the electric power industry;
- Power system risk and resiliency dependency.

In the article "Intelligent Islanding Detection of Microgrids Using Long Short-Term Memory Networks" [1], a new intelligent islanding detection scheme is presented, which is based on empirical wavelet transform and a long short-term memory network to identify islanding events in microgrids. To extract the features from three-phase signals, the concept

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of empirical wavelet transform is extended. The simulation results verify the effectiveness of the proposed intelligent islanding detection scheme in terms of non-detection zone, computational time, detection accuracy and robustness against noisy measurement. So far, this article has been cited once and viewed 477 times.

The authors of the article "Evaluating the Functioning Quality of Data Transmission Networks in the Context of Cyberattacks" [2] propose a new method for use in the evaluation of the quality of the functioning of data transmission networks, based on modeling the process of data transmission networks' operation in the form of a stochastic network. This method provides the possibility to evaluate the quality of network functioning in the context of cyberattacks for stationary Poisson transmission and self-similar traffic, represented by Pareto and Weibull flows models. So far, the article has been viewed 477 times.

The third article of the Special Issue is "Energy Community Flexibility Solutions to Improve Users' Wellbeing" [3]. This article presents a novel methodology which proves how flexibility in the energy community can contribute to each community member's wellbeing when a grid fault occurs. Non-controllable and controllable devices are considered by the authors as models of household consumers. As power supply sources, PV systems installed in a community's houses are considered, as well as the power obtained from the main grid. Each house's flexibility inside the community was studied to improve the management of loads during a fault occurrence. Furthermore, energy flexibility can be used to create better energy price markets, to improve the resilience of the grid or even to consider electrical vehicles' connection to a community's grid. To date, the article has been cited twice and viewed 510 times.

In their article entitled "A Case Study of an Industrial Power Plant under Cyberattack: Simulation and Analysis" [4], the authors analyze cyberattacks as dangerous threats to power systems. From this point of view, it is proven that the most vulnerable parts of a power system are human–machine interfaces, electrical equipment and Surveillance, Control and Data Acquisition (SCADA) systems. A simulation of cyberattacks on existing electrical equipment from a petrochemical plant (case study), which consists of modifying the remote data transmitted by the SCADA system, is implemented. Furthermore, the changes that occur following each fault resulting from the cyberattack and the influence of the electrical parameter changes upon the process flow are analyzed. Furthermore, by using Electrical Power System Analysis Software—ETAP—the changes that occur following each fault due to the cyberattack and the influence of the electrical parameter changes upon the process flow are analyzed. By considering the two malfunction events, the resilience assessment of the system is analyzed. To date, the article has been cited once and viewed 683 times.

The fifth article of the Special Issue is entitled "The Energetic-Environmental-Economic Feasibility and Impact Assessment of Grid-Connected Photovoltaic System in Wastewater Treatment Plant: Case Study" [5]. A case study of the synergy between wastewater treatment plants and photovoltaic systems, aiming to improve the energetic, environmental and economic impacts, is presented. Based on data acquisition, the energy consumption analysis of wastewater treatment plant reveals that the highest demand is during April, and the lowest is during November. The placement of photovoltaic modules is designed to maximize the use of free space on the technological area of a wastewater treatment plant in order to obtain a power output that is as high as possible. The peak consumption of the wastewater treatment plant occurs in April; however, the peak production of the photovoltaic system is in July, and so, electrochemical batteries can partly compensate for this mismatch. The impact of the photovoltaic system connectivity on the power grid is assessed by means of the matching-index method, and the storage battery significantly improves this parameter. Carbon credit and energy payback time are used to assess the environmental impact. The results prove that the photovoltaic system mitigates 12,118 tons of carbon, and the embedded energy is compensated by production in 8 $\frac{1}{2}$ years. The economic impact of the photovoltaic system is analyzed using the levelized cost of energy, and the results show that the price of energy from the photovoltaic source is below the current market price of energy. To date, the article has been cited 6 times and viewed 1135 times.

We thank all of the authors for their contributions of articles of very good scientific quality, the results of which have aroused the interest of the readers of the *Energies* journal. We would also like to thank the staff of the *Energies* journal and the reviewers for their efforts and help.

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