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*Editorial*

# Special Issue "Renewable and Sustainable Energy Conversion Systems"

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In the current quest for new energy sources, green, environmentally friendly energy has taken a preponderant role. A clean and sustainable way to meet rising energy demands is essential for the survival and development of our civilization.

However, the energy supplied by solar, wind, or fuel cells, geothermal energy or ocean waves does not fit within the parameters suitable for direct application to electrical grids. Power electronic conversion systems are required at the frontend of the grids or stand-alone consumers supplied by novel sources of energy, in order to assure stable, controllable power regardless of the variation in natural factors such as insolation, wind intensity, etc.

As the title indicates, this Special Issue covers a multitude of theoretical facets and practical applications, each paper here referring to a different subtopic, from solar cells and ocean thermal energy supplied systems, microgrids and the management of modern systems formed by environmentally friendly sources of energy, to detailed applications such as AC–AC converters and non-polluting electric vehicles.

The solution to a practical problem in photovoltaics-based applications opens this Special Issue [1]. In the classical series connection of solar cells and their accompanying storage modules, the MPPT (maximum power point tracking) fails under partial shade. The paper proposes a novel cascaded modular photovoltaic-energy storage system, in which an independent MPPT of each solar cell and a constant active power between the cell-storage module and the grid are assured in all practical conditions. By applying an energy optimization strategy in the new structure, 97% efficiency is obtained even under partial shade.

The second paper [2] brings us to another source of green energy: ocean thermals. An ocean profiler driving system powered by ocean thermal energy is proposed. For a classical underwater vehicle that can work in a very limited period of time due to its limitations in regard to stored energy, such a sustainable ocean-thermal-energy-powered electro-hydraulic control system is a key element in its activity. A rigorous design of the system and a mathematical model of the flow control lead to a reduced consumption of energy and to a better service life of the underwater platform.

A general problem related to the protection architecture of a microgrid is the subject of the third paper [3]. The purpose of this work is to design a fast and reliable digital protection scheme for both the grid-connected and islanded modes of operation. Protective modules for each region of a microgrid are proposed and implemented. A coordination algorithm is then developed. The proposed adaptive scheme includes two steps: in the first, offline step, all settings are adopted for selective and sensitive fault detection, isolation, and coordination among the proposed protective modules; in the second, online step, any change in the system is detected, and thus new settings for the proposed modules are used to adapt the settings accordingly.

In a modern power system constituted by unpredictable renewable energy sources, battery energy storage systems and variable consumers, the danger of lower reliability and increased uncertainty and variability in the generation of electricity can affect the electricity market dynamics and the power system security. A virtual aggregation environment platform is proposed in [4] for realizing an effective coordinated action of the distributed

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resources and the smart consumers. Without using a central mediator (aggregator), the proposed platform architecture allows consumers of any kind (residential, commercial and industrial) to work together, by sharing and combining their flexibility in a coordinated way, allowing for the selection of the winning offer.

A detailed study of a typical component of a power electronics system is given in [5]. A new modulation strategy is proposed for a compact single-phase six-switch AC–AC converter, the structure of which necessitates large DC-link energy storage capacitors. A sophisticated mathematical analysis creates the fundamentals of the new modulation strategy. It allows a fast charging and discharging of the DC-link capacitor to the load, thus requiring a minimum energy storage. Under the same DC-link voltage ripple constraint, a lower capacitance value of the storage capacitor is thus needed. The system efficiency, power density, and output waveform quality are improved.

Finally, a subject related to the modern, increasingly utilized, environmentally clean, non-polluting electric and hybrid vehicles is discussed in [6]: an inductive power transfer procedure is used for charging the batteries of such vehicles, thus eliminating cables and connectors. The battery-charging mode in stationary parking requires the use of a relatively simple inductive power transfer method, with just the need of position adjustment for efficient transfer. However, a dynamic road-driving charging mode needs a more complicated inductive power transfer system, with smart sensors and control strategies as well as communication devices. Intelligent communication between the electrical vehicle and the infrastructure system is needed. However, driving mode charging is more advantageous and less time consuming from the point of view of the driver. The paper investigates these problems and proposes methods for the optimization of the contactless charging of the batteries of electric vehicles.

The presented Special Issue is not only non-exhaustive, but the absolute contrary is true. It is the editors' belief that the presented papers will stimulate more research in the field and will start a chain of increasing numbers of papers in an area which is vital for the development of a clean environment.

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