Guest Editorial

Renewable energy systems have received renewed interest due to the rising price of conventional energies and environmental concerns. Several aspects must be addressed in order to improve the energy harvest in terms of new power topologies, new control strategies, and maximum power point tracking (MPPT). On the other hand, the connection of these systems to the grid presents a completely new research area where synchronization with distorted grid, detection of islanding, and the creation of microgrid and smart grid are key concepts.

It is our pleasure to present this "Special Section on Renewable Energy Systems—Part 1." The papers of the first part of this Special Section are classified by energy sources (wind, photovoltaic (PV), hydro, etc), grid-related issues (islanding, synchronization, microgrid and smart grid), and converters for renewable-energy sources.

A. Energy Sources

Wind energy has become an important energy source with mature and reliable technology. However, several technological aspects remain to be addressed, as shown in the papers "Simplified Modeling of a DFIG for Transient Studies in Wind Power Applications" by A. Luna *et al.* and "Efficiency Impact of Silicon Carbide Power Electronics for Modern Wind Turbine Full Scale Frequency Converter" by H. Zhang and L. M. Tolbert. Strategies for MPPT are still an interesting research topic, as shown in "A Novel Algorithm for Fast and Efficient Speed-Sensorless Maximum Power Point Tracking in Wind Energy Conversion Systems" by S. M. R. Kazmi *et al.* and "Neural MPPT Control of Wind Generators With Induction Machines Without Speed Sensors" by M. Pucci and M. Cirrincione. Moreover, the control of complete wind-energy conversion systems (WECS) introduces new and sophisticated control methods, as shown in the papers "Gain-Scheduled $H\infty$Control for WECS via LMI Techniques and Parametrically Dependent Feedback Part I: Model Development Fundamentals and Part II: Controller Design and Implementation" by E. B. Muhando *et al.*

The continuous growth of the PV market worldwide has generated greater interest in this topic. Along with wind energy, the search for the maximum power point is covered by the following papers: "An Improved Maximum Power Point Tracking for Photovoltaic Grid-Connected Inverter Based on Voltage-Oriented Control" by R. Kadri *et al.* and "A Multivariable Perturb-and-Observe Maximum Power Point Tracking Technique Applied to a Single-Stage Photovoltaic Inverter" by G. Petrone *et al.* Other control issues are addressed in the Digital Object Identifier 10.1109/TIE.2010.2085210 paper "Power Control Design of a Battery Charger in a Hybrid Active PV Generator for Load-Following applications" by H. Fakham *et al.*

The use of combined wind and hydro energy, as shown in the paper "Energy Management and Power Control of a Hybrid Active Wind Generator for

Distributed Power Generation and Grid Integration" by T. Zhou and B. François is an interesting and cost-effective alternative.

Oceans can be harvested for energy using waves or marine currents, as shown in the papers "Modeling and Simulation of Wave Energy Generation Plants: Output Power Control" by M. Amundarain *et al.* and "Experimental Validation of a Marine Current Turbine Simulator: Application to a Permanent Magnet Synchronous Generator-Based System Second-Order Sliding Mode Control" by S. Benelghali *et al.*

B. Grid-Related Issues

Connecting renewable energies to the electrical grid is not an easy task because several requirements must be met. Synchronization is one of the most important requirements, particularly in distorted grids, as shown in Multiresonant Frequency-Locked Loop for Grid Synchronization of Power Converters Under Distorted Grid Conditions" by P. Rodríguez *et al.*

Nowadays, detection of islanding conditions has received increasing attention, as seen in the papers "Impact of Load Frequency Dependence on the NDZ and Performance of the SFS Islanding Detection Method" by H. H. Zeineldin and M. M. A. Salama and "Control for Grid-Connected and Intentional Islanding Operations of Distributed Power Generation" by I. J. Balaguer *et al.*

Distributed energy generation has added importance to microgrids and smart grids, particularly in terms of control, communications, and effective use. These concepts are addressed in the following papers: "Hierarchical Control of Droop-Controlled AC and DC Microgrids—A General Approach Toward Standardization" by J. M. Guerrero *et al.* and "The Provision of Frequency Control Reserves From Multiple Microgrids" by C. Yuen *et al.*

C. Converters for Renewable Energies

Almost every renewable-energy system requires power converters to be efficiently harvested and connected to the electrical grid. Particularly, in PV systems, several dc–dc new topologies and configurations are proposed and reviewed in "A New High-Efficiency Single-Phase Transformerless PV Inverter Topology" by T. Kerekes *et al.* and "Quasi-Z-Source-Based Isolated DC/DC Converters for Distributed Power Generation" by D. Vinnikov and I. Roasto.

Inverter topologies and control to connect renewable energies to the electrical grid are proposed in "A Robust Control Scheme for Grid-Connected Voltage-Source Inverters" by S. Yang *et al.*

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