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Editorial: Planning and operation of hybrid renewable energy systems, Volume II

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Editorial on the Research Topic
Planning and operation of hybrid renewable Energy systems, Volume II

Renewable energy contributes to clean and economic energy systems. However, it also poses a great challenge to the operation of energy systems in terms of current, voltage, and frequency problems in power systems due to the intermittency and uncertainty of renewable energy. This Frontiers Research Topic aims to present state-of-the-art studies on solving these problems. There are in total 11 articles accepted for this Research Topic after careful peer-to-peer review, and they cover the following three categories.

Current, voltage control, and harmonic analysis

To deal with the poor active modulation of the working mode of converters and the large current stress in the Buck circuit of DC-DC converters, Li et al. propose an improved frequency/amplitude modulation control strategy. To improve the efficiency of dual active bridge converters, including a reduction of the effective value of current and a widening of the soft switching area, Shi et al. propose an optimized extended phase-shift modulation strategy. Voltage stability is greatly influenced by the doubly-fed induction generator at the point of common coupling, where wind farms are integrated into the bulk power grid. Liu et al. propose a reactive power compensation strategy to achieve the expected voltage quality of the power grid via a minimum amount of control actions in emergencies. The triggering of the Tokamak power supply in nuclear fusion energy provides spectrum-rich harmonics to the DC side of the power supply and threatens the operational safety of the Tokamak device; thus, He et al. propose a harmonic analysis method to examine the DC side. Zhang explore the influence of driving and parasitic parameters on the switching behaviors of a SiC MOSFET since its behaviors affect the efficiency and power density of converters.

Frequency control

You et al. suggest a dynamic power-based stepwise inertial control scheme for a wind power plant to minimize secondary frequency dip and reduce the maximum frequency deviation. Wei et al. propose a frequency control scheme for the LCC-HVDC sending end system based on the concept of rapid power compensation to improve the frequency characteristics of the renewable energy sending end grid. Bi et al. propose a coordinated active/reactive power-control strategy for the VSC-HVDC system based on the rapid power compensation mode to suppress grid electromechanical and frequency oscillations.

Operation with renewable energy

Zhang et al. determine a feasible region model for an integrated energy system, according to the capacity of key equipment and its pipeline capacity, using the multi-energy balance equation. Dong et al. propose a two-stage, robust optimization operation model of a hybrid AC-DC distribution network to handle the stochastic uncertainty of the distributed renewable energy output and to minimize the total system operational cost. With batteries largely integrated in energy systems, it is important to estimate their state of charge. Yang et al. propose an optimized state of charge estimation algorithm based on an extended kalman filter.

Overall, energy systems face great challenges regarding the integration of renewable energy, including voltage, current, and frequency problems. Further study is still required to better address the problems in hybrid renewable energy systems.

Author contributions

HW wrote the article and other authors gave suggestions and did the proof reading. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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