

Guest Editorial: Power Systems with Increasing Renewable Penetration: Market, Operations, Planning and Regulation

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Our goal in putting together this special section is to contribute to the conversation on control, operations, planning and regulation of power systems with increasing renewable penetration. Such a conversation will hopefully involve regulators, operators, producers, consumers, and the research community. We hope that this special section will spur innovative ideas that will contribute to ensuring a secure, efficient, and environmentally friendly supply of electrical energy, and to eventually achieve a carbon-free electricity sector.

This special section includes 15 research articles on control, operations, regulation, planning, forecasting, and estimation of power systems with increasing renewable penetration.

On the control front:

1) The paper entitled “A Fuzzy Hierarchical Strategy for Improving Frequency Regulation of Battery Energy Storage System” proposes a control strategy for a battery to maximize its revenue from frequency regulation while preventing operating conditions that shorten its life.

On the operation front:

2) The paper entitled “Optimal Operation of an Integrated Electricity-heat Energy System Considering Flexible Resources Dispatch for Renewable Integration” provides an innovative model for the coordinated operation of power and heat systems.

3) The paper entitled “Optimal Decomposition of Stochastic Dispatch Schedule for Renewable Energy Cluster” proposes a decomposition methodology to optimally schedule wind farms within stochastic programming framework.

4) The paper entitled “Day-ahead Risk-constrained Stochastic Scheduling of Multi-energy System” provides a scheduling tool for a generation system including thermal, hydro, wind and solar units.

5) The paper entitled “Locational Marginal Pricing Mechanism for Uncertainty Management Based on Improved Multi-ellipsoidal Uncertainty Set” explores a locational marginal

pricing scheme for systems with significant stochastic production.

6) The paper entitled “Coordinated Operation of Concentrating Solar Power Plant and Wind Farm for Frequency Regulation” describes a model that coordinates a wind farm and a concentrated solar power unit for frequency regulation.

7) The paper entitled “Frequency-constrained Co-planning of Generation and Energy Storage with High-penetration Renewable Energy” proposes a methodology for the operation of a system including thermal, wind, and storage units, which incorporates frequency regulation constraints.

On the regulatory front:

8) The paper entitled “Equilibria in Interdependent Natural-gas and Electric Power Markets: an Analytical Approach” proposes a stylized equilibrium model for regulatory studies including power and natural-gas systems.

On the planning front:

9) The paper entitled “Two-step Optimal Allocation of Stationary and Mobile Energy Storage Systems in Resilient Distribution Networks” proposes a methodology to locate stationary and mobile batteries to improve the reliability of a distribution system.

10) The paper entitled “Potential Assessment of Spatial Correlation to Improve Maximum Distributed PV Hosting Capacity of Distribution Networks” proposes a technique to increase the PV penetration of a distribution system by taking advantage of the spatial correlations among distributed PV units.

11) The paper entitled “A Reliability Model for Integrated Energy System Considering Multi-energy Correlation” provides a reliability analysis for multi-energy systems considering correlations among different energy systems.

12) The paper entitled “A Two-stage Adaptive Robust Model for Residential Micro-CHP Expansion Planning” provides an insightful procedure for the adoption of residential combined-heat-and-power units.

On the forecasting front:

13) The paper entitled “Forecasting Scenario Generation for Multiple Wind Farms Considering Time-series Characteristics and Spatial-temporal Correlation” proposes a scenario generation methodology for wind power units.

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14) The paper entitled “Synthetic Time Series Generation Model for Analysis of Power System Operation and Expansion with High Renewable Energy Penetration” provides a technique to generate synthetic time series to characterize the output of renewable energy resources.

On the estimation front:

15) The paper entitled “Power Factor Estimation of Distributed Energy Resources Using Voltage Magnitude Measurements” proposes an estimation technique regarding injections and power factors of distributed energy units.

We are truly thankful to the Guest Editors that have shepherded the reviews of all the articles considered for this special section in a most efficient and efficacious manner: Juan J. Alba, Kyri A. Baker, Yury Dvorkin, Jalal Kazempour, Hui Liu, Nian Liu, Line Roald, Yishen Wang, Wei Wei, and Xuan Wu. Thank you!

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