Guest Editorial Introduction to the Special Section on Energy Storage Applications for Smart Grid

IT IS TRULY A privilege serving on the editorial board of this Special Section on Energy Storage Applications for Smart Grid. The issue discusses many innovative approaches, methodologies, and applications of using energy storage technologies for providing a variety of grid energy and ancillary services for integrating variable generations and enhancing the performance and reliability of power grid operation.

The application of storage technologies to the electrical power system has evolved over time. Many of the issues faced at the turn of the last century are similar to the challenges we face today. Common challenges include the rapid advancement of technology at a time of uncertain structure of the electric power industry. Then as now, physics and economics are the necessary ingredients for the successful applications of such a technology. The large scale development of energy storage presents both risks and opportunities. Storage will affect the reliability of the power system and there will be a need for improved modeling of the net load forecasts, resource performance, and market operations. Storage could also provide more efficient use of the transmission and distribution systems, facilitate the development of variable resources, and improve the economic and environmental performance of electric power production resources.

This aim of this Special Section is to present applications of electrical energy storage. The issue summarizes the most recent research and development and it identifies issues that must be addressed for the successful application of storage technologies.

We were extremely impressed by the number of papers submitted in response to the Call for Papers and the spectrum of interests that the international community has for energy storage. The papers solicited discuss a broad range of environmental, economic, technical, market, and policy considerations associated with the application of energy storage on power systems. Out of 83 submissions, we were able to accept 22 exceptional contributions. The final paper selection was made based on the quality of the papers and an attempt to balance a broad topical representation. The final papers were divided into five topical areas as follows:

1) Hybrid Storage Management System and its Applications in Microgrids:

- CERTS Microgrid Demonstration With Large-Scale Energy Storage and Renewable Generation
- Management of Battery-Supercapacitor Hybrid Energy Storage for Isolated Operation of PMSG Based Wind Turbine Generator Systems
- Power Management for DC Microgrid Enabled by Solid-State Transformer
- An SOC-Based Battery Management System for Microgrids

2) Storage for Active Distribution Networks

- A Decentralized Storage Strategy for Residential Feeders With Photovoltaics
- Sizing Strategy of Distributed Battery Storage System With High Penetration of Photovoltaic for Voltage Regulation and Peak Load Shaving
- Adaptive Control for Energy Storage Systems in Households With Photovoltaic Modules
- Local Voltage Control Strategies for PV Storage Systems in Distribution Grids
- Control and Optimization of Grid-tied Photovoltaic Storage Systems Using Model Predictive Control
- Integrating Electrical Energy Storage Into Coordinated Voltage Control Schemes for Distribution Networks
- Electrical Vehicle Batteries Testing in a Distribution Network Using Sustainable Energy

3) Energy Storage for Provision of Ancillary Services

- A Coordinating Algorithm for Dispatching Regulation Services Between Slow and Fast Power Regulating Resources
- V2G Capacity Estimation Using Dynamic EV Scheduling
- Stochastic Optimization of Grid to Vehicle Frequency Regulation Capacity Bids
- Dynamic Available AGC Based Approach for Enhancing Utility Scale Energy Storage Performance
- PEV Storage in Multi-Bus Scheduling Problems

4) Energy Storage for Integration of Renewable Resources

- Optimal Operation of Independent Storage Systems in Energy and Reserve Markets With High Wind Penetration
- Whole-Systems Assessment of the Value of Energy Storage in Low-Carbon Electricity Systems
- Impacts of Energy Storage on Short Term Operation Planning Under Centralized Spot Markets
- A Novel Market Simulation Methodology on Hydro Storage

5) Operation of Energy Storage for Reliability

- Power System Reliability Impact of Energy Storage Integration With Intelligent Operation Strategy
- Energy Storage for Relief of Transmission Congestion

As guest editors of this volume, we thank all of the authors for their innovative works in this increasingly important area. We are also grateful to our many colleagues who reviewed the submitted papers and assisted greatly in improving the quality

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