Guest Editorial
Special Section on Smart Grid Technology in South Korea

SMART GRID is the next-generation electric grid which would enable a more efficient utilization of generation, transmission, distribution, and energy delivery. This evolution is becoming essential for a transition to a more sustainable energy infrastructure and the reduction in adverse effects on the environment. While advances in certain areas of technology such as renewable energy and hierarchical network control are critical, further developments in communication technology, data fusion and mining, as well as day-ahead scheduling and optimization are also crucial in order to achieve this vision.

The Republic of Korea, the world's fifth-largest oil importer, would require ratcheting up the renewable energy utilization in its total consumption from 2.4 percent in 2008 to 11 percent by 2030. Korea plans to initially invest $1.8 billion on smart grid technologies by 2015, giving utility customers the ability to monitor price and supply as an incentive to lower their energy usage during high-demand periods. A demonstration project on Jeju Island, as a part of the Korea's smart grid initiative, is a comprehensive program that focuses on the smart power grid, smart consumers and smart electricity services. This is an initial step toward its goal of a completely integrated smart grid by 2030. Furthermore, the Korean government has declared that it is planning to invest as much as $2.4 billion on smart grid technology by 2030 for reducing its annual power consumption by 10 percent.

This Special Section of IEEE TRANSACTIONS ON SMART GRID includes a detailed presentation of Korean smart grid implementation. The papers in this Special Section cover a broad range of smart grid topics including system configuration and operation, economics, reliability, state estimation, and other technology applications. This Special Section comprises 13 papers in which 4 papers focus on system configuration and operation, 3 papers deal with the economic issues in smart grid, 4 papers focus on reliability and state estimation in the system, and the remaining 2 papers introduce additional technologies with applications to smart grid. A brief description of the selected papers is provided here:

System configuration and operation:
— "Advanced Power Distribution System Configuration for Smart Grid," J. Kim, S. Cho, H. Shin. This paper analyzes the advantages of an APDS loop structure for loss reduction and voltage regulation. It also presents a loop path selection algorithm for loss minimization.
— "Smart Operation of HVDC Systems for Large Penetration of Wind Energy Resources," D. Yoon, H. Song, G. Jang, S. Joo. This paper proposes an optimal operation strategy for the economic and stable operation of intelligent power systems with multiple HVDC components.
— "Operation Schemes of Smart Distribution Networks with Distributed Energy Resources for Loss Reduction and Service Restoration," I. Song, W. Jung, J. Kim, S. Yun, J. Choi, S. Ahn. This paper proposes intelligent control functions for DER units in Smart Distribution Networks. In addition, the integration schemes in Smart Distribution Networks with DER units are introduced and analyzed.
— "Design of Smart Distribution Management System for Obtaining Real-Time Security Analysis and Predictive Operation in Korea," I. Song, S. Yun. S. Kwon, N. Kwak. This paper presents the analytical design and strategies for the implementation of the Korean Smart Distribution Management System (KSDMS).

System economics:
— "Design of Time-varying Rate Considering CO2 Emission," T. Hahn, Z. Tan, W. Ko. This paper proposes an efficient dynamic pricing method with taxation on CO2 emission and market power mitigation.
— "Consumers' Price Elasticity of Demand Modeling with Economic Effects on Electricity Markets Using an Agent-Based Model," P. Thimmapuram, J. Kim. This paper describes an agent-based model for demonstrating and quantifying the economic impacts of price elasticity of demand on electricity markets when consumers equipped with smart grid technologies would respond to demand fluctuations.
— "Power Scheduling of Distributed Generators for Economic and Stable Operation of a Microgrid," S. Ahn, S. Nam, J. Choi, S. Moon. This paper analyzes the optimal economic operation of a microgrid with distributed generators (DGs).

Reliability and state estimation:
— "State Estimation for Supervisory Monitoring of Substations," S. Park, E. Lee, W. Yu, H. Lee, J. Shin. This paper introduces the application of state estimation to double bus double breaker distribution substations, which are typically used in the Korean power system, to improve the reliability of substation automation systems.
— "Study of the Effectiveness of a Korean Smart Transmission Grid Based on Synchro-Phasor Data of K-WAMS," J. Kim, B. Lee, S. Han, J. Shin. T. Kim, S. Kim, Y. Moon. This paper presents the architecture and main functionalities of the Korean WAMS installed by the KEPCO power grid in the Republic of Korea.
— "Modified Dynamic Phasor Estimation Algorithm for the Transient Signals of Distributed Generators," D. Lee, S. Kang, S. Nam. This paper proposes a dynamic phasor esti-

mation method for the fundamental frequency component with a time-variant amplitude.

— "DSM considered Probabilistic Reliability Evaluation and an Information System for Power Systems Including Wind Turbine Generators," J. Choi, J. Lim, K. Lee. This paper proposes a methodology and web-based analyses of the daily interval reliability information system for evaluating the reliability of a composite power system with wind turbine generators (WTG) and demand side management.

New technology application:

— "A Quantitative Analysis on Future World Marketability of HTS Power Industry," J. Yoon, S. Lee, I. Hwang. This paper analyzes the expected marketability of HTS equipment such as HTS cables, transformers, FCL, and rotating machines.

— "Analysis of Consumer Preferences for Electric Vehicles," W. Ko, T. Hahn. This paper analyzes the Korean consumer preferences for EV on the basis of stated preferences.

As always, we would like to thank all authors who worked diligently and participated tirelessly on the completion of this Special Section. We would also like to thank Prof. Mohammad Shahidehpour, EIC of the IEEE Transactions on Smart Grid, for the guidance and assistance provided during the course of development of the Special Section. We hope you enjoy the articles.

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