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SPECIAL ISSUE

SMART GRID: THE ELECTRIC ENERGY SYSTEM OF THE FUTURE

Edited by H. Gharavi and R. Ghafurian

922 **Challenges and Opportunities in Smart Grid: A Position Article** By G. W. Arnold INVITED PAPER This introductory article gives an overview of the concepts and

purpose of the Smart Grid and the important role of communications technology in its development.

Smart Generation and Transmission With Coherent, Real-Time Data 928 By D. E. Bakken, A. Bose, C. H. Hauser, D. E. Whitehead, and G. C. Zweigle INVITED PAPER | The bulk power system and power applications for wide area measurement are discussed in this paper and a set of baseline requirements for data delivery systems is derived.

A Multilevel State Estimation Paradigm for Smart Grids 952 By A. Gómez-Expósito, A. Abur, A. de la Villa Jaén, and C. Gómez-Quiles CONTRIBUTED PAPER | The authors of this paper describe a multilevel state estimator architecture that can sustain growth in size, complexity of data, and information.

Translational Knowledge: From Collecting Data to Making Decisions 977 in a Smart Grid

By M. Kezunovic

INVITED PAPER | Converting data to knowledge is the main concern of this paper, which provides a new data processing solution and illustrates it through several applications.

For the Grid and Through the Grid: The Role of Power Line 998 **Communications in the Smart Grid**

By S. Galli, A. Scaglione, and Z. Wang

INVITED PAPER | The role of power line communications in the Smart Grid is addressed in this paper, which presents a review of what these communications can offer.

- **Multigate Communication Network for Smart Grid** 1028 By H. Gharavi and B. Hu INVITED PAPER | Wireless mesh networking is the main concern of this paper, which describes techniques to enhance network performance in terms of reliability, latency and throughput.
- 1046 High-Assurance Smart Grid: A Three-Part Model for Smart Grid **Control Systems**

By T. M. Overman, R. W. Sackman, T. L. Davis, and B. S. Cohen INVITED PAPER | Cyber security and control for future Smart Grid systems is the topic of this paper, which recommends distributed control for grid management and hierarchical control for planning and dispatch.

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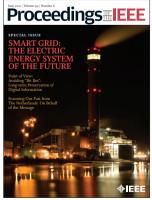
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Smart Grid: The Electric Energy System of the Future By H. Gharavi and R. Ghafurian

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On the Cover: This month we explore the Smart Grid: The Electric Energy System of the Future, and our cover is an unusual photograph of a partially illuminated power plant at night.

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1063 Options for Control of Reactive Power by Distributed Photovoltaic Generators

By K. Turitsyn, P. Šulc, S. Backhaus, and M. Chertkov |CONTRIBUTED PAPER| This paper presents challenges and opportunities for distribution utilities, simulates options for managing reactive power, and discusses benefits of choosing local variables to control the system.

1074 Smart Distribution: Coupled Microgrids

By R. H. Lasseter

|INVITED PAPER | The author of this paper believes that use of microgrids can simplify implementation of many Smart Grid functions, including reliability, self-healing, and load control.

Advances in Wind Energy Technologies in the Context of Smart Grid By M. Glinkowski, J. Hou, and G. Rackliffe INVITED PAPER Interconnection of large wind farms with the power grid can add a new degree of control to the power system, according to the authors of this paper.

1098 Adaptive Stochastic Control for the Smart Grid

By R. N. Anderson, A. Boulanger, W. B. Powell, and W. Scott [CONTRIBUTED PAPER] The main theme of this paper is that creation of the Smart Grid will provide self-healing capabilities and improved efficiency and allow load and source management for better performance.

1116 Vehicle Electrification: Status and Issues

By A. G. Boulanger, A. C. Chu, S. Maxx, and D. L. Waltz |INVITED PAPER| Current development and the challenges and opportunities for global adoption of electric vehicles are explored in this paper; these vehicles are said to empower people to effect change.

1139 The Role of Energy Storage in Development of Smart Grids

By B. P. Roberts and C. Sandberg

|INVITED PAPER | Energy storage aspects of the Smart Grid are discussed in this article; various storage technologies are reviewed and the importance of storage systems in electric grid operation is described.

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