



Guest Editorial: Special Issue on Low-Carbon Electricity

Chongqing KANG (✉)

Global warming has been one of the most serious worldwide problems for a long time. A very large proportion of the carbon emissions are generated by the electric power industry from fossil fuel combustion. Therefore, the promotion of low-carbon electricity is imperative to achieve sustainable development of power industry. Low-carbon electricity faces both opportunities and challenges. Low-carbon power system is bound to play a unique role with the development of low-carbon society all over the world.

Development of low-carbon electricity is inseparable from the support of all kinds of new technologies. With the efforts of both academia and industry, new types of low-carbon electricity technologies emerge mushrooming from the traditional thermal power sector to the renewable energy. The construction of pilot carbon trading, the demonstration of carbon capture power plant and other aspects of low-carbon technologies have achieved initial results. Even the low-carbon electricity technology has broad development potential; it is still in its infancy, which means more types of low-carbon electricity technologies have yet to be deepened. Low-carbon electricity has become a hot issue with the development of the global power industry.

I am honored to be invited to serve as the Guest Editor-in-Chief of the Special Issue for Journal of Modern Power Systems and Clean Energy (MPCE) on

“Low-Carbon Electricity”. With the inclusion of 15 papers, this Special Issue focuses on strategies, mechanisms, techniques and methods of low-carbon development of power industry, showing the latest research progress of both domestic and international scholars on low-carbon electricity. This Special Issue has a wide variety of paper sources, covering universities, research institutions and power companies. Except for 9 domestic papers, there are 6 papers from overseas, including the United States, Japan, Australia, Denmark and India.

The papers in this Special Issue can be divided into 4 subtitles as follows.

1) Planning of low-carbon power system

Prof. Ravikumar BHIMASINGU and his student Y. V. Pavan KUMAR from Indian Institute of Technology Hyderabad, present a cost-effective and environment-friendly hybrid power system model for buildings. In the study by Australia scholars Prof. Zhaoyang DONG, Prof. Kit Po WONG, and Jing QIU, a risk-based probabilistic transmission expansion planning model considering carbon pricing policies and uncertainties in electricity market is proposed. Prof. Yi DING and Chunyu ZHANG from Technical University of Denmark proposed a stochastic multi-period multi-objective transmission planning model to reduce correlated uncertainties from renewable energy generation, conventional generation, demand-side variations, market price volatility and transmission configuration. A bi-level formulation is presented by

Received: 5 January 2015 / Published online: 10 February 2015
C. KANG, The State Key Lab of Power Systems, Department of Electrical Engineering, Tsinghua University, Beijing 100084, China
(✉) e-mail: cqkang@tsinghua.edu.cn



Prof. Yue YUAN and Yang CAO from Hohai University, China to optimize the proportion of wind and PV capacity for provincial power systems.

2) Dispatch of low-carbon power systems

Prof. YOKOYAMA and Mr. Ken KURODA from Waseda University, Japan proposed an improved method of multi-objective optimization for critical challenges to realize advanced power systems. In the study by Dr. Hao HUANG from Customized Energy Solutions in Philadelphia, USA and Prof. Fangxing LI from University of Tennessee, USA, a bidding strategy is modeled and solved as a bi-level optimization problem. Prof. Jinyu WEN and Mr. Jiaming LI from Huazhong University of Science and Technology, China proposed a stochastic unit commitment model to meet the low-carbon operation requirement and to cope with wind power prediction errors. The study by Songsong CHEN and Huaguang YAN from China Electric Power Research Institute focuses on automated demand response systems architecture and residential customer's auto-demand response technology roadmap.

3) Stability and control of low-carbon power systems

Prof. John Ning JIANG and Di WU from University of Oklahoma, USA present a preliminary study of the distribution impact of the inertia contributions from the online synchronous generators on the rate of frequency change. The study by Prof. Gangui YAN from Northeast Dianli University, China focuses on the development of a control strategy to optimize the coordination of multiple energy storage systems. A relevant preventive control strategy aiming at maintaining the static voltage stability margin of power system above a predefined security level is proposed by Prof. Hongjie JIA and Mr. Mingshen WANG from Tianjin University, China. Prof. Weisheng WANG and Shuo YANG from China Electric Power Research Institute proposed an optimal reactive power dispatch strategy of clustered wind power plants considering the static voltage stability for low-carbon power system.

4) Performance evaluation of a low-carbon power system

Prof. Chongqing KANG and Dr. Xiaoming DONG

from Tsinghua University, China proposed a scheme to estimate the energy consumption in constructing an overhead transmission line, and another scheme to estimate the energy consumption in operation. Via analyzing the production process and electricity consumption distribution, Prof. Zhaoguang HU from State Grid of Energy Research Institute, China and Mingtao YAO from Beijing Jiaotong University, China investigated the industrial users' response characteristics involving the ancillary service type and the response capacity of cement and electrolytic aluminum. Prof. Shaoyun GE from Tianjin University, China proposed a pseudo-sequential Monte Carlo simulation method for the low-carbon benefit evaluation of distribution system including distributed wind turbines, solar array and battery energy storage system.

I am immensely fortunate to dedicate this Special Issue as the Guest Editor-in-Chief. I would like to express my heartiest gratitude to Editor-in-Chief Professor Yusheng XUE and Prof. Kit Po WONG, Ms. Qing WANG for inviting me to this propitious task. I am highly impressed by these excellent scientific articles, and I would like to thank all the authors of this Special Issue for their great insights to these important topics. I am grateful to all reviewers for their thoughtful comments to improve the quality of the papers. I highly appreciate the help from Director Zhihong WANG as the planning editor of this Special Issue.

In the end, I wish that this Special Issue will be a valuable resource for future research on low-carbon electricity.

Guest Editor-in-Chief

Professor
Chongqing KANG
Tsinghua University, China

January 5, 2015