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ENERGY DEVELOPMENT AND POWER GENERATION COMMITTEE

PANEL SESSION: DEVELOPMENTS IN POWER GENERATION AND TRANSMISSION INFRASTRUCTURES IN CHINA[#]

(Tom Hammons, K. P. Wong, and Loi Lei Lai)

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Sponsored by: International Practices for Energy Development and Power Generation
Wednesday June 27, 2:00 ~ 6:00 p.p.

Chairs: T. J. Hammons, University of Glasgow, Scotland, UK
K. P. Wong, Hong Kong Polytechnic University, Hong Kong, China
L. L. Lai, City University London, UK

On behalf of the Energy Development and Power Generation Committee, welcome to this Panel Session on Developments in Power Generation and Transmission Infrastructures in China.

This Panel Session is of special significance. Eminent specialists on China are contributing. The panel will discuss new technologies in power generation, transmission and distribution in China. It will present an in-depth analysis on key issues of development of the China power industry, electricity in rural area, renewable energy, environmental protection, operational safety and security, information technology and automation. Highlighted will be space-time cooperative defense against blackouts, electricity market infrastructure and operating systems, the challenges for bulk power system protection, developments of the power industry and its impact on R&D, and market incentives for long-term transmission generation capacity adequacy

The Panelists and Titles of their Presentations are:

1. Panel Session Introductory Paper: T. J. Hammons (University of Glasgow, UK), K. P. Wong (Hong Kong Polytechnic University, Hong Kong) and L. L. Lai (City University London, UK). Developments in Power Generation and Transmission Infrastructures in China (Paper 07GM 0433)
2. Yin Yonghua, Chief Engineer, CEPRI, Beijing, China. Electric Power Systems in China—History of Development, Present Status and Future Perspectives (Paper 07GM0769)
3. Yu-sheng Xue, NARI, Najing, China. Towards Space-Time Cooperative Defense Against Blackouts in China (Paper 07GM 0557)
4. Yanmin Song, NARI, China and Xiao-Ping Zhang, Director of the Institute for Energy Research and Policy, The University of Birmingham, UK. The Chinese Electricity Market Infrastructure and Operation Systems: Current Status and Future Developments (Paper 07G0852)
5. Qixun Yang, Board Chairman, Beijing Sifang Automation Co. Ltd., China and Bi Tianshu, Professor, North China Electric Power University, China. WAMS Implementation in China and the Challenges for Bulk Power System Protection (Paper 07GM0839)
6. Shuyong Chen, Feili Huang, Baohui Zhang, Yixin Ni, Libao Shi and Zheng Xu, Various Institutions, China. Fast Development of Chinese Power Industry and its Impacts on Power System R&D Outputs (Paper 07GM 0807)
7. Xingwang Ma, Electricity Market Consulting Inc., Bellevue, WA, USA. Reliability Compliant Market: Incentives for Long-Term Transmission and Generation Capacity Adequacy (Paper 07GM0862)

[#] Document prepared and edited by T. J. Hammons

Each Panelist will speak for approximately 20 minutes. Each presentation will be discussed immediately following the respective presentation. There will be a further opportunity for discussion of the presentations following the final presentation.

The Panel Session has been organized by K. P. Wong (Hong Kong Polytechnic University, Hong Kong), T. J. Hammons (Chair of International Practices for Energy Development and Power Generation IEEE PES, University of Glasgow, UK)., and L. L. Lai (City University London, UK). Tom Hammons, K. P. Wong and Loi Lei Lai will moderate the Panel Session.

The first presentation is an in-depth Panel Session Introduction presentation entitled: Developments in Power Generation and Transmission Infrastructures in China. It is by T. J. Hammons (University of Glasgow, UK), K. P. Wong (Hong Kong Polytechnic University, Hong Kong), and L. L. Lai (City University London, UK). L. L. Lai, K. P. Wong and T. J. Hammons, Panel Session Co-Chairs will present it.

T. J. Hammons (F'96) received the degree of ACGI from City and Guilds College, London, U.K. and the B.Sc. degree in Engineering (1st Class Honors), and the DIC, and Ph.D. degrees from Imperial College, London University.

He is a member of the teaching faculty of the Faculty of Engineering, University of Glasgow, Scotland, U.K. Prior to this he was employed as an Engineer in the Systems Engineering Department of Associated Electrical Industries, Manchester, U. K. He was Professor of Electrical and Computer Engineering at McMaster University, Hamilton, Ontario, Canada in 1978-1979. He has authored/co-authored over 350 technical articles and papers.

K. P. Wong (F'02) obtained M.Sc. and Ph.D. degrees from the University of Manchester, Institute of Science and Technology, UK in 1972 and 1974, respectively. Prof. Wong was awarded a higher doctorate D.Eng. degree by UMIST in 2001. He is currently a Chair Professor and is the Head of Department of Electrical Engineering, Hong Kong Polytechnic University.

L. L. Lai (F'07) received the B.Sc. (First Class Honors) and the Ph.D. degrees from the University of Aston in Birmingham, UK. He also gained his D.Sc. from City University London. Currently he is Head of Energy Systems Group at City University, London, UK. He is a Visiting Professor at Southeast University, Nanjing, China and also a Guest Professor at Fudan University, Shanghai, China. He has authored/co-authored over 200 technical papers.

The second presentation has been prepared and will be presented by Yin Yonghua, Chief Engineer, China Electric Power Research Institute (CEPRI), Beijing, China. It is entitled Electric Power Systems in China—History of Development, Present Status and Future Perspectives.

This presentation deals with the history of development, present status and future perspective of electric power system in China. The development of a nationwide interconnected grid, purpose of interconnection, key projects and R&D necessary for the future are discussed. The nationwide interconnected grid will be basically established in 2020 and become one of largest power systems in the world.

Yin Yonghua received his BS in Electrical Engineering from the North-East Electrical Power Institute, in 1976; and his MS in Electrical Engineering from the Graduate School of CEPRI in1981. Presently, he is Chief Engineer, China Electric Power Research Institute (CEPRI). From 1998 to 2006 he was Director, Power Systems Department and Deputy Chief Engineer , CEPRI

The third presentation has been prepared and will be presented by Yu-sheng Xue, NARI, Najing, China. It is entitled: Towards Space-Time Cooperative Defense Against Blackouts in China.

With investigations into recent blackouts around the world, the three-defence-lines criterion, which has been the security standard for power systems in China, is reviewed. An adaptive space-time cooperative framework, named as Wide Area Monitoring Analysis Protection-control (WARMAP) for defending power system against blackouts is introduced. It upgrades the individual defence lines to a global scheme. Its essentials are: (1) acquiring wide area measures by using RTUs, PMUs, fault recorders, protection management systems and system protection schemes; (2) integrating all information acquired via various equipments into a unified platform; (3) performing trajectory-based data mining and quantitative security analysis for time response curves obtained by PMUs or simulations; (4) adaptive optimization of preventive control, emergency control, corrective control and recovery control; (5) coordination among these controls; (6) coordinatin among WARMAPs in a multi-layer power system. It is well on the way to building WARMAPs in a two-layer power grid in China, which consists of East China Regional Grid and Jiangsu Province Grid. The method is discussed and elaborated on in the presentation.

Y. Xue obtained his PhD in Electrical Engineering from the University of Liege (Belgium) in 1987. He became a Member of Chinese Academy of Engineering in 1995 and has been the Chief Engineer at Nanjing Automation Research Institute (NARI), China since 1993. His research interests include nonlinear stability, control and power system automation.

The fourth presentation is by Yanmin Song, NARI, China and Xiao-Ping Zhang, Director of the Institute for Energy Research and Policy, The University of Birmingham, UK. It is entitled: The Chinese Electricity Market Infrastructure and Operation Systems: Current Status and Future Developments. Xiao-Ping Zhang will present it.

At the end of 2005 the installed generation capacity of 500 GW made China the second highest in electricity production in the world. As China is being transformed into the manufacturing center of the world, the increase of electricity demand is tremendous. New electric energy infrastructure – the super high voltage power grid is required to transfer bulk electricity energy over a very long distance in order to meet the need of social and economic development. This presentation discusses the infrastructure of the electricity market in China along with the development of the energy infrastructure. Then the Electricity Market Operation System (EMOS) and its application in China are presented. Finally the future development of the electricity market in China is summarized.

Yanmin Song received the BEng., MSc. and Ph.D. degrees in Electrical Engineering from Southeast University, Nanjing Automation Research Institute (NARI), State Grid Corporation, and Southeast University, China in 1983, 1988, 2006, respectively. She is now a visiting fellow in the School of Engineering at the University of Warwick. She is Vice Chief Engineer of Power System Control Division, Nanjing Automation Research Institute (NARI), State Grid Corporation of China. She is a corresponding member of IEC TC 57 Working Group 16. She is also the secretary of Electricity Market Working Group of National Power System Control and Associated Communications Standard Committee in China. Her research interests include the design, modeling, and operations of electricity markets.

Xiao-Ping Zhang (SM'06) received the BEng., MSc. and Ph.D. degrees in Electrical Engineering from Southeast University, China in 1988, 1990, 1993, respectively. He was with Nanjing Automation Research Institute (NARI), State Grid Corporation of China on EMS/DMS advanced application software research & development from 1993 to 1998. Dr. Zhang was an Alexander-von-Humboldt Fellow at the University of Dortmund, Germany from 1999 to 2000. He was an associate professor in the School of

Engineering at the University of Warwick, Coventry, U.K., and he is now the Director of the Institute of Energy Research and Policy at the University of Birmingham, U.K.

The next presentation is by Qixun Yang, Board Chairman, Beijing Sifang Automation Co. Ltd., China and Bi Tianshu, Professor, North China Electric Power University, China. It is entitled: Wide Area Measurement System (WAMS) Implementation in China and the Challenges for Bulk Power System Protection. Qixun Yang will present it.

Synchronized phasor measurement technology has been gaining increasingly interests in China due to its wide area time synchronization capability and fast transmission speed. Over 10 years of implementation of WAMS in Chinese power grid have shown its great value in power system dynamic monitoring and potential applications in system modeling and validation, feed-back control and system wide protection. This presentation reviews the overall implementation of WAMS in China and analyzes the corresponding characteristics of WAMS. Moreover the challenges for bulk power system protection with synchronized phasor measurement technology are presented also.

Qixun Yang received B.Sc and Ph.D degrees from Zhejiang University, P.R. China and South Wales University, Australia in 1960 and 1982 respectively. He is currently a Chinese academician of engineering and a professor of North China Electric Power University. He is also the Board Chairman of Beijing Sifang Automation Co. Ltd. His research interests include power system protection and control, and substation automation.

Tianshu Bi received master and Ph.D. degrees from North China Electric Power University, P.R. China and The University of Hong Kong in 1997 and 2002 respectively. She is currently a professor of North China Electric Power University and vice director of the Key Lab of Power System Protection and Dynamic Monitoring and Control under MOE. Her research interests include power system protection and control, WAMS applications and the fault diagnose.

Jingtao Wu was born in 1970, in Beijing P.R.China. He got his BS, MS and PhD from Tsinghua University in 1995, 1998 and 2001 respectively. In 2002, he joined the Beijing SIFANG Automation Co., Ltd. He is in charge of the development of wide area measurement system. By the end of 2005, more than six WAMS data centers has been realized by his working group, and more than hundred PMU installed in 220kV and 500kV power grid. His interest is WAMS technology and its applications.

The sixth presentation is by Shuyong Chen, Feili Huang, Baohui Zhang, Yixin Ni, Libao Shi and Zheng Xu of various Institutions, in China. It is entitled: Fast Development of Chinese Power Industry and its Impacts on Power System R&D Outputs. Shuyong Chen will present it.

The rapid growth of Chinese economy leads to fast development of the electric power industry, which greatly promotes higher education on electrical engineering and the research and development (R&D) on power systems in China. In the meantime, the Ministry of Science & Technology of China (MSTC) and the National Natural Science Foundation of China (NSFC) play an important role in planning and supporting key and basic research projects on critical issues in power industry. Here, the rapid growth of Chinese power industry is outlined. The NSFC sponsorship on power system relevant R&D is presented. The R&D output in China is then shown through paper publications. Finally the issues in power system R&D in China are discussed.

Shuyong Chen received his Ph. D. degree in EE from EPRI, China in 1998. His research interest is in wind energy. He once worked as a visiting scholar on renewable energy in Oldenberg Univ., Germany

in 1995 and in NREL, USA in 1997. He is now the director of the Editorial Board of Proceedings of the CSEE and the chief editor of 'Electricity Information', a newspaper on power systems in China.

Feili Huang received her B. Eng. degree in EE from Tsinghua University. She once worked in Canada as a visiting scholar on power electronics. Her research interest is in power electronics and its applications in machine drives and power systems. She is now a senior engineer (professor grade) and the director of Electrical Engineering Division, the Department of Engineering and Materials Science, NSFC.

Baohiu Zhang received his Ph. D. degree in EE from Xi'an Jiaotong University. His research interest is in power system protective relay and AI technology applications in power systems. He is now a professor in Xi'an Jiaotong University, and also serves as the chairman of the Association for Leaders of Electric Power Education Institutes in China.

Yixin Ni received her Ph. D. degree in EE from Tsinghua University in 1983. Her research interest is in power system dynamics, HVDC transmission and FACTS, new technology applications in power systems and power markets. She was formerly a professor in Tsinghua University and now with the University of Hong Kong.

Libao Shi received his Ph. D. degree in EE from University of Chongqing. He was a postdoctoral in Shanghai Jiaotong University and once visited the University of Queensland, Australia and the University of Hong Kong, Hong Kong, China. He is now an associate professor in the Tsinghua University Graduate School at Shenzhen. His research interest is in EMS, DMS and computer and AI technology applications in power systems.

Zheng Xu received his Ph. D. degree in EE from Kyushu University of Industry, Japan in 1992. He once worked in Panasonic, Japan for three years as a designer of power electronic devices. He is now an associate professor in the Tsinghua University Graduate School at Shenzhen. His research interest is in power engineering.

The final presentation discusses Reliability Compliant Market: Incentives for Long-Term Transmission and Generation Capacity Adequacy. It has been prepared by Xingwang Ma, Electricity Market Consulting Inc., Bellevue, WA, USA. L. L. Lai will present it.

Electricity restructuring is centered on economic efficiency as well as grid reliability for both short and long terms. Successful markets are characterized with the common key elements. The key market elements include: locational marginal pricing (LMP), financial transmission right (FTR) and co-optimized energy and ancillary service market. As critical components of a successful market design, risk hedging mechanisms are discussed in the presentation including multi-settlement scheme, virtual bidding and bilateral contracts. Market mechanisms for long-term transmission and generation capacity adequacy are under development in the US and will be discussed. Examples are used to demonstrate the workings of the key market elements.

Xingwang Ma received his B.S. from Hefei University of Technology, China and his M.S. from the Graduate School, EPRI, China in 1983 and 1985, respectively. He worked with AREVA T&D from 1996 to 2006. He founded Electricity Market Consulting Inc providing independent consulting services on the design and implementation of electricity market and market operation systems.