

International Practices in Developments and Techniques in Smart Grids

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Working Group European Electricity Infrastructure

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Track 6: Smart Grids

INTRODUCTION

Power and energy are the most important business, political and social issues of the time. Electricity deregulation has created market demands and associated opportunities, and obligations. In the last two decades or so, the way electricity is generated and users that can have choices have resulted in a fundamental need to change electricity networks worldwide to meet future challenges. Global warming is influencing policies that require energy usage and greenhouse emissions to be measured and controlled. Market pressures, including increasing energy demands, assets management, quality and reliability of energy supply, and growing social concern for the environment will force business that is based upon innovation.

In many countries, electricity networks are 40 to 50 years and more old and in many situations, there is an important question when the companies are going to replace them to take the opportunity for new thinking and to take into account many challenges such as climate change, new customer requirements, and innovative technology opportunities. To address the challenge a vision for a practical way forward and a way forward that will bring benefits to mankind is required.

The introduction of robust, high-bandwidth computer networks has created the possibility of distributing intelligence down to the equipment level. This would involve the derivation of additional data parameters from the initial set of measurements. Such

a capability could be extended 'self-checking' algorithms that would assess validity of the readings taken by the instruments. This could be extended further to involve diagnosis of the equipment that the sensors directly monitor.

Because of the nature of various types of power system problems, different types of intelligent techniques may be required. Real world power system problems may neither fit the assumptions of a single technique nor be effectively solved by the strengths and capabilities of a single technique. One approach to deal with these complex real world problems is to integrate the use of two or more techniques in order to combine their different strengths and overcome each other's weaknesses to generate practical solutions.

The future of power grids is expected to involve an increasing level of intelligence and integration of new information and communication technologies in every aspect of the electricity system, from demand-side devices to wide-scale distributed generation to a variety of energy markets.

Smart networks includes the development of new concepts, system architectures and a regulatory framework for control, supervision and operation of electricity networks to transform the grid into an interactive service network between customers and operators, while maximizing reliability, power quality, efficiency, security and reducing carbon emission. These systems should be based on applications of distributed intelligence and e trading

Communications architecture and standards include development of the architectural framework

and related standards needed to share information and form an interoperable network from generators, through transmission and distribution, to consumers. Policy-makers and decision-makers should more actively create opportunities for joint activities such as the SmartGrid in Europe and GridWise in USA.

The smart grids include smart metering and the ability to integrate power generated locally or remotely. New methods of controlling bulk public power flows across national boundaries will enable the cleanest sources to be tapped to supply electricity at national and international level. The grid is able to learn to coordinate all equipment for optimal expected performance despite random disturbances. The bottom line includes value added, quality of service, reliability, security, etc.

Some of the key persons of the advisory council will participate with technical presentations.

The Panelists and Titles of their Presentations are:

1. Tom Hammons (Glasgow University, UK), L.L. Lai (City University London, UK) and K.P. Wong Hong Kong Polytechnic University, China). International Practices in Smart Grid Design, Operation, Control and Management (Invited Panel Presentation Summary 09GM0152)
2. YiXin Cai and Mo-Yuen Chow (North Carolina State University, USA). Exploratory Analysis of Massive Data for Fault Diagnosis in Smart Grids (Invited Panel Presentation Summary 09GM0739).
3. Ringo Lee (Powerpeg NSI Ltd., Hong Kong, China) and L.L. Lai (City University London, UK). Smart Metering in Micro-Grid Applications (Invited Panel Presentation Summary 09GM1585).
4. Ganesh K. Venayagamoorthy (Missouri University, USA). Potential and Promises of Computational Intelligence for the Smart Grid (Invited Panel Presentation Summary 09GM1443).
5. Adam Berry, David Cornforth and Glenn Platt (CSIRO Energy Technology, NSW, Australia). An Introduction to Multi-objective Optimization Methods for Decentralized Power Planning (Invited Panel Presentation Summary 09GM0669).
6. Preetika Kulshrestha, Lei Wang, Mo-Yuen Chow and Srdjan Luikie (North Carolina State University, USA). Intelligent Energy Management System Simulator for PHEVs at Municipal Parking Deck in a Smart Grid Environment (Invited Panel Presentation Summary 09GM0737).
7. Steven Kong, David Cornforth and Adam Berry. (CSIRO Energy Technology, NSW, Australia). A New Approach to the Design of Multiple Inverter Systems using Evolutionary Optimization (Invited Panel Presentation Summary 09GM0087).
8. Zhao Xu, Mark Gordon, Morten Lind and Jacob Østergaard (Technical University of Denmark, Denmark). Towards a Danish Power System with 50% Wind--Smart Grid Activities in Denmark (Invited Panel Presentation Summary 09GM0927).
9. David Cornforth (CSIRO Energy Technology, NSW, Australia). Applications of Data Mining to Time Series of Electrical Disturbance Data (Invited Panel Presentation Summary 09GM0683).
10. Hui Wan, H.J .Lai, Sridhar Chouhan, Ali Feliachi and Muhammad A. Choudhry (West Virginia University, USA). Intelligent Reconfiguration of Smart Distribution Network using Multi-agent Technology (Invited Panel Presentation Summary 09GM1224).
11. Zhenghua Jiang, Fangxing Li, Wei Qiao, Hongbin Sun, Hui Wan, Jianhui Wang, Yan Xia, Zhao Xu., Pei Zhang. A Vision of Smart Transmission Grids (Invited Panel Presentation Summary 09GM1112).
12. Invited Discussers.

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 is organized by Loi Lei Lai (Professor, City University London, UK), Kit Po Wong (Professor, Hong Kong Polytechnic University, Hong Kong) and Tom Hammons (Chair of International Practices for Energy Development and Power Generation IEEE, University of Glasgow, UK).

Tom Hammons, Loi Lei. Lai, and Kit Po Wong will moderate the Panel Session.

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BIOGRAPHIES



Thomas James Hammons (F'96) received the degree of ACGI from City and Guilds College, London, UK. 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, UK. He was Professor of Electrical and Computer Engineering at McMaster University, Hamilton, Ontario, Canada in 1978-1979. He was a Visiting Professor at the Silesian Polytechnic University, Poland in 1978, a Visiting Professor at the Czechoslovakian Academy of Sciences, Prague in 1982, 1985 and 1988, and a Visiting Professor at the Polytechnic University of Grenoble, France in 1984. He is the author/co-author of over 400 scientific articles and papers on electrical power engineering. He has lectured extensively in North America, Africa, Asia, and both in Eastern and Western Europe.

Dr Hammons is Chair of International Practices for Energy Development and Power Generation of IEEE, and Past Chair of United Kingdom and Republic of Ireland (UKRI) Section IEEE. He received the IEEE Power Engineering Society 2003 Outstanding Large Chapter Award as Chair of the United Kingdom and Republic of Ireland Section Power Engineering Chapter (1994~2003) in 2004; and the IEEE Power Engineering Society Energy

Development and Power Generation Award in Recognition of Distinguished Service to the Committee in 1996. He also received two higher honorary Doctorates in Engineering. He is a Founder Member of the International Universities Power Engineering Conference (UPEC) (Convener 1967). He is currently Permanent Secretary of UPEC. He is a registered European Engineer in the Federation of National Engineering Associations in Europe.



Kit Po WONG (M'87-SM'90-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. UMIST awarded Prof. Wong a higher doctorate DEng degree in 2001. Prof. Wong is currently Chair Professor of the Department

of Electrical Engineering, Hong Kong Polytechnic University and an Adjunct Professor of School of EECE at The University of Western Australia. He was Guest Professor at Tsinghua University, Beijing, China and is Guest Professor at Southeast University, Nanjing, China. Prof. Wong was a Professor at the University of Western Australia. During this period he received three Sir John Madsen Medals (1981, 1982 and 1988) from the Institute of Engineers Australia, the 1999 Outstanding Engineer Award from the IEEE Power Chapter Western Australia and the 2000 IEEE Third Millennium Award. Professor Wong has published numerous research papers in power systems and on the applications of artificial intelligence and evolutionary computation to power system planning and operations. His current research interests include evolutionary optimization in power, power market analysis, power system planning and operation in the deregulated environment, and power quality. Professor Wong has served as Editor in Chief for IEE

Proceedings Generation, Transmission and Distribution. He was the Conference Chair of IEEE/CSEE PowerCon2000. He is a Fellow of IEEE, IEE, HKIE and IEAust.



Loi Lei LAI (SM'92, F'2007) 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 Professor and Head of Energy

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