

June 28 2007

**IEEE POWER ENGINEERING SOCIETY
ENERGY DEVELOPMENT AND POWER GENERATION COMMITTEE**

**PANEL SESSION: INTERNATIONAL PRACTICES IN DISTRIBUTED GENERATION
DEVELOPMENT WORLDWIDE[#]**

Room CC #22

IEEE 2007 General Meeting, Tampa, USA, 24-28 June 2007

Thursday June 28, 9:00 am—4:00 pm

Sponsored by: International Practices for Energy Development and Power Generation

Chairs: T. J. Hammons, University of Glasgow, Scotland, U.K., E-mail: T.Hammons@ieee.org
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On behalf of the Energy Development and Power Generation Committee, welcome to this Panel Session on International Practices in Distributed Generation Development Worldwide.

The experience of power industry restructuring in many countries of the world shows the reliability-related difficulties and problems encountered. Transition to a competitive model of power industry organization has called for thorough and comprehensive studies. In this Panel Session, distinguished speakers with deep knowledge and first-hand experience will make presentations. They will analyze and compare experiences of different countries considering:

- Specific features of economic interrelations between different subjects of relations-- generation and network companies; power supply organizations, and consumers;
- Principles of providing reliability of electrical power systems and power supply;
- Economic mechanisms for coordinating the interests of the different subjects of relations.

The Panelists and Titles of their Presentations are:

1. T. J. Hammons (International Practices for Energy Development and Power Generation IEEE, University of Glasgow, Scotland, U.K.) and L. L. Lai (City University London, U.K.). International Practices in Distributed Generation Development Worldwide (Paper 07GM0434).
2. Kwang Y. Lee (Pennsylvania State University, U.S.A.) and Se-Ho Kim (Cheju National University, Korea). Progress in Distributed Generation in Korea (Paper 07GM0963).
3. Norman Tse (City University of Hong Kong, Hong Kong). Wavelet Based Algorithm for Power Quality Analysis (Paper 07GM0496).
4. V. S. Pappala and I. Erlich (University of Duisburg-Essen, Germany). Management of Distributed Generation Units under Stochastic Load Demands using Particle Swarm Optimization (Paper 07GM0751).
5. Nikos Hatziaargyriou, Zoe Vrontisi, and Antonis G. Tsikalakis (National Technical University of Athens, Greece), and Vasilis Kiliadis (Center of Renewable Energy (CRES), Athens, Greece). The Effect of Island Interconnections on the Increase of Wind Power Penetration in the Greek System (Paper 07GM1075).
6. Tze-Fun Chan (Hong Kong Polytechnic University, Hong Kong) and Loi Lei Lai (City University London, U.K.). Permanent-Magnet Machines for Distributed Power Generation: A Review. (Paper 07GM0593).

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

7. Khaled A. Nigim (University of Waterloo, Canada) and Wei-Jen Lee (University of Texas at Arlington, TX, U.S.A.). Micro Grid Integration Opportunities and Challenges. (Paper 07GM0284).
8. Yuping Lu, Lidan Hua, Ji'an Wu, Gang Wu, and Guangting Xu (Southeast University, Nanjing, China). A Study on Effect of Dispersed Generator Capacity on Power System Protection. (Paper 07GM0503).
9. Umakant Dhar Dwivedi, S. N. Singh and S. C. Srivastava (IIT, India). Analysis of Transient Disturbances in Distribution Systems: A Hybrid Approach (Paper 07GM1015).
10. Ringo Lee, (Powerpeg NSI Limited, Hong Kong), and L. L. Lai (City University London, U.K.). A Practical Approach to Wireless GPRS On-line Power Quality Monitoring System (Paper 07GM1010).

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.

L. L. Lai (City University London, U.K.) and T. J. Hammons have organized the Panel Session. Tom Hammons and Loi Lei Lai will moderate it.

PRESENTATIONS

The first presentation is an in-depth Panel Session Introduction entitled: International Practices in Distributed Generation Development Worldwide. It has been prepared and will be presented by T. J. Hammons (International Practices for Energy Development and Power Generation IEEE, University of Glasgow, Scotland, U.K.) and L. L. Lai (City University London, U.K.).

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 paper

L. L. Lai (F'07) received the B.Sc. (First Class Honors) and the Ph.D. degrees from the University of Aston in Birmingham, U.K. 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 is by Kwang Y. Lee (Pennsylvania State University, U.S.A.) and Se-Ho Kim (Cheju National University, Korea). It is entitled: Progress in Distributed Generation in Korea.

This presentation discusses the progress in distributed generation in Korea. Government policy has emphasized three different renewable energy sources, hydrogen and fuel cell, photovoltaic, and wind power. Concerning renewable energy, the government plans to replace 5% of the primary energy source by the year 2011. The road map for the three major renewable energy sources will be presented.

Kwang Y. Lee (Fellow IEEE) received his B.S. degree in Electrical Engineering from Seoul National University, Korea, in 1964, his M.S. degree in Electrical Engineering from North Dakota State University, Fargo, in 1968, and his Ph.D. degree in System Science from Michigan State University, East Lansing, in 1971. He has been with Michigan State, Oregon State, Univ. of Houston, and the Pennsylvania State University, where he is now a Professor of Electrical Engineering and Director of Power Systems Control Laboratory. Dr. Lee is Associate Editor of IEEE Transactions on Neural Networks, and Editor of IEEE Transactions on Energy Conversion. He is also a registered Professional Engineer.

Se Ho Kim was born in Seoul, Korea in 1961. He received his B.S., M.S. and Ph.D. degrees in electrical engineering from Yonsei University, in 1983, 1985 and 1992, respectively. Currently, he is a Full Professor in the Department of Electrical and Electronics Engineering, Cheju National University, Jeju, Korea. His current research interests include power system operation, renewable energy resources, wind power system, distributed system automation, and grounding systems. Dr. Kim is a member of IEEE and KIEE.

The third presentation has been prepared and will be made by Norman Tse (City University of Hong Kong, Hong Kong). It is entitled: Wavelet Based Algorithm for Power Quality Analysis.

It presents a computational algorithm for identifying power frequency harmonics and oscillatory transients by using a wavelet-based transform. The Continuous Wavelet Transform (CWT) using the Complex Morlet Wavelet (CMW) is adopted. A frequency detection algorithm is developed from the wavelet scalogram and ridges. A necessary condition is established to discriminate adjacent frequencies. By using adaptive wavelet filters, the instantaneous frequency identification approach is applied to determine the frequencies components and the oscillatory transient. Simulated data was used and will be discussed to demonstrate the accuracy of this approach.

Norman, C. F. Tse was born in Hong Kong, China. He graduated from the Hong Kong Polytechnic University (then Hong Kong Polytechnic) in 1985. He obtained his MSc degree from the University of Warwick in 1994. He is a Chartered Engineer, a corporate member of the IET, UK and the Hong Kong Institution of Engineers. He is now working with the City University of Hong Kong as a Senior Lecturer majoring in building LV electrical power distribution systems.

The fourth presentation is by V. S. Pappala and I. Erlich, University of Duisburg-Essen, Germany. It is entitled: Management of Distributed Generation Units under Stochastic Load Demands using Particle Swarm Optimization. Istvan Erlich will present it.

It discusses a Particle Swarm Optimization (PSO) approach to manage the daily electricity and heat generation in proton exchange membrane (PEM) fuel cells for residential applications under electrical demand uncertainties. The stochastic load processes are modeled as scenario trees using adaptive PSO. The resulting multistage non-linear stochastic cost model aims to minimize the average operating costs over this scenario tree. Adaptive PSO is used to solve this model and the results are compared with the deterministic model.

Venkata Swaroop Pappala received the B.E. degree in electrical engineering from Faculty of Electrical engineering, S.V.H. College of engineering, India in 2002, and the M.Sc. degree in electrical engineering from University Duisburg-Essen, Germany in 2005. His research interests include stochastic optimization under uncertainty using evolutionary algorithms.

Istvan Erlich received his Dipl.-Ing. Degree in electrical engineering from the University of Dresden, Germany in 1976. After his studies, he worked in Hungary in the field of electrical distribution networks. From 1979 to 1991, he joined the Department of Electrical Power Systems of the University of Dresden again, where he received his Ph.D. degree in 1983. Since 1998, he is Professor and Head of the Institute of Electrical Power Systems at the University of Duisburg-Essen, Germany. His major scientific interest is focused on power system stability and control, modeling and simulation of power system dynamics including intelligent system applications.

The fifth presentation is by Nikos Hatziargyriou, Zoe Vrontisi, and Antonis G. Tsikalakis (National Technical University of Athens, Greece), and Vasilis Kiliass (Center of Renewable Energy (CRES), Athens, Greece). It is entitled: The Effect of Island Interconnections on the Increase of Wind Power Penetration in the Greek System. Nikos Hatziargyriou will present it.

Greece is a country with many dispersed islands where favorable conditions for exploiting RES exist. Cyclades is a group of islands that some of them are not so far away to be interconnected with the mainland and among them. This interconnection will reduce the need for operating the local oil-fired stations and extending the area they occupy to meet future needs. The Interconnection of Cyclades to the mainland and exploitation of the favorable wind conditions of the area will be examined in the presentation.

Nikos D. Hatziargyriou received the Diploma in Electrical and Mechanical Engineering from NTUA and M.Sc. and Ph.D. degrees from UMIST, Manchester, U.K. He is professor at the Power Division of the Electrical and Computer Engineering Department of NTUA.

Zoe N. Vrontisi received the Diploma in Electrical and Computer Engineering from NTUA. Her research interests include Dispersed and Renewable Generation, Energy Planning and Energy Economics.

Antonis G. Tsikalakis received his diploma in Electrical and Computer Engineering from NTUA. He is currently with the Electrical and Computers Engineering Department of NTUA. His research interests include optimization of power system operation, Dispersed Generation and energy storage.

Vasillis Kiliass is Head of Information Systems, Center of Renewable Energy, Athens, Greece.

The sixth presentation is entitled: Permanent-Magnet Machines for Distributed Power Generation--A Review. Tze-Fun Chan (Hong Kong Polytechnic University, Hong Kong), and Loi Lei Lai (City University London, U.K.) have prepared it. Loi Lei Lai will present it.

It will give a review of permanent-magnet machines for distributed power generation. Radial-flux, linear and axial-flux machine configurations will be discussed with reference to generation that utilizes energy resources such as wind, wave energy, and natural gas. Isolated operation and grid-connected operation are also considered. Some of the authors' research work on a surface-inset permanent-magnet synchronous generator for autonomous power system application is also included.

T. F. Chan received the B.Sc. (Eng.) and M.Phil. Degrees in electrical engineering from the University of Hong Kong, Hong Kong, China, in 1974 and 1980, respectively. He received the

Ph.D. degree in electrical engineering from City University, London, U.K., in 2005. Currently, Dr. Chan is an Associate Professor, Department of Electrical Engineering, Hong Kong Polytechnic University, Hong Kong, China.

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 has authored/co-authored over 200 technical papers.

Khaled A. Nigim (University of Waterloo, Canada) and Wei-Jen Lee (University of Texas at Arlington, TX, U.S.A.) have prepared the seventh presentation. It is entitled: Micro Grid Integration Opportunities and Challenges.

Penetration of distributed generation poses significant new challenges and has benefits to the existing electricity market structure. This presentation discusses the opportunities and challenges facing integration of the micro grids with existing utilities and concludes with the required steps needed to minimize the challenging factors.

Khaled Nigim (SM) has a Ph.D. in Electrical Engineering from the University of Leicester, England, UK and B.Sc. in Electrical Engineering from Zagazig University of Cairo, Egypt. He is the Coordinator of the on-line Master of Engineering degree in Electric Power 'MEng and GDip graduate program' at the Department of Electrical & Computer Engineering, University of Waterloo.

Wei-Jen Lee, received his B.S. and M.S. degrees in Electrical Engineering from National Taiwan University, Taipei, Taiwan, in 1978 and 1980, respectively, and a Ph.D. degree in Electrical Engineering from the University of Texas at Arlington in 1985. Currently is a Professor of the Electrical Engineering Department.

The eighth presentation is by Yuping Lu, Lidan Hua, Ji'an Wu, Gang Wu, and Guangting Xu of Southeast University, Nanjing, China. It is entitled: A Study on Effect of Dispersed Generator Capacity on Power System Protection. Yuping Lu will present it.

When a fault occurs on a distribution system, the load center with Distributed Generation will have a significant impact on the protection. The impact depends on the number, location and amount of the injected DG. This presentation focuses on studying the effect of DG on conventional protection. Examples are used to demonstrate the various issues and solutions.

Yuping Lu received his Ph.D. degree in electrical engineering from the City University, U.K. in 2003. Currently, he is a Professor in Southeast University of China. His research interests are in power system protection, especially digital relaying of generator-transformer unit, and protection and control technique in distribution system with DGs.

Lidan Hua received her Bachelor's degree in electrical engineering from Southeast University in June 2004. Her current research interest is in protection and control of distribution system with DGs.

Ji'an Wu graduated with B.E. and M.E. degrees from Southeast University in July 1982 and April 1989, respectively. Now he is working as chief engineer in Guodian Nanjing Automation Co. Ltd. His research interest is in power system protection.

Gang Wu received the Bachelor's degree in electrical engineering from Hohai University in June 2004. His current interest is in protection and control of distribution system with DGs.

Guangting Xu is pursuing her M.E. degree at Southeast University, Nanjing, China. Her current interest is in protection and control of distribution system with DGs.

The penultimate presentation is entitled: Analysis of Transient Disturbances in Distribution Systems--A Hybrid Approach. It is by Umakant Dhar Dwivedi, S. N. Singh and S. C. Srivastava (Indian Institute of Technology, India). Umakant Dhar Dwivedi will present it.

Built-in event diagnosis and assessment modules are the key to the power quality monitoring systems. Discrete wavelet transform has been used recently by many researchers for detection and analysis of power quality disturbances. This presentation will discuss current developments in the technology involved.

U. D. Dwivedi received his B. Tech degree in Electrical & Electronics engineering from National Institute of Technology (NIT) Calicut, India, in 1997 and M. Tech degree in electrical engineering from the Indian Institute of Technology Kanpur, in 2003. His research interests include power quality, signal-processing applications to power systems, FACTS, and adjustable speed drives.

S. N. Singh received the Ph.D. degree in Electrical Engineering from the Indian Institute of Technology Kanpur, India, in 1995. Currently, he is an Associate Professor in the Department of Electrical Engineering at the Indian Institute of Technology Kanpur.

S. C. Srivastava received the B.Tech degree in Electrical Engineering from Banaras Hindu University, Varanasi, India, in 1976 and the Ph.D. degree from the Indian Institute of Technology Delhi, India, in 1987. Currently, he is a Professor with the Electrical Engineering Department, Indian Institute of Technology, Kanpur, India. His research interests include energy management system, power system optimization, security analysis, voltage stability analysis, and power system restructuring.

The final presentation is entitled: A Practical Approach to Wireless GPRS On-line Power Quality Monitoring Systems. Ringo Lee, Director, "Your Network System Integrator", Powerpeg NSI Limited, Hong Kong and L. L. Lai (City University London, UK) have prepared it. Ringo Lee will make the presentation.

The presentation discusses the way to adopt the cost effective GPRS applications. The authors focus the application of the GPRS to on-line system applications and the techniques. A practical scheme is proposed and its use in real-life systems will be introduced. A practical implementation for a wireless GPRS on-line Power Quality Monitoring System will be illustrated. Results and benefit to the end users in some practical applications will also be discussed.

Lee. P.K. Ringo received the B.Eng (First Class Honors) from University of Sunderland (former Sunderland Polytechnic), U.K., in 1991. Currently he is Director of Powerpeg NSI Limited in Hong Kong that is a network system integrator for Intelligent Power Management/Monitoring System for both supply and demand sides in HK.

L. L. Lai (F'07) received the B.Sc. (First Class Honors) and the Ph.D. degrees from the University of Aston in Birmingham, U.K., in 1980 and 1984, respectively. He was awarded the D.Sc. by City University London in 2005.