# **45th Annual Frontiers of Power Conference 2012**

Stillwater, Oklahoma, USA 29-30 October 2012

ISBN: 978-1-62276-517-1

#### Printed from e-media with permission by:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2012) by Oklahoma State University – Engineering Energy Laboratory All rights reserved.

Printed by Curran Associates, Inc. (2013)

For permission requests, please contact Oklahoma State University – Engineering Energy Laboratory at the address below.

Oklahoma State University – Engineering Energy Laboratory 216 Engineering South Stillwater, OK 74078-0321

Phone: (405) 744-5157 Fax: (405) 744-9198

www.okstate.edu

#### Additional copies of this publication are available from:

Curran Associates, Inc. 57 Morehouse Lane Red Hook, NY 12571 USA Phone: 845-758-0400

Fax: 845-758-2634

Email: curran@proceedings.com Web: www.proceedings.com

# TABLE OF CONTENTS

KEYNOTE ADDRESS	1
Ram Adapa, Ph.D.P.E., Fellow IEEE	
Power Delivery and Utilization	
Electric Power Research Institute (EPRI)	
Palo Alto, California	
Role of Power Electronics in Future Electric Smart Grid	
KEYNOTE ADDRESS	22
Miroslav M. Begovic, Ph.D., Fellow, IEEE	
Professor	
Chair, Electric Energy Research Group	
School of Electrical and Computer Engineering	
Georgia Institute of Technology	
Atlanta, Georgia	
President-Elect, IEEE Power & Energy Society	
Renewable Energy Technologies: the Present and Future of Photovoltaics	
	63
KEYNOTE ADDRESS	
Murty V. V. S. Yalla, Ph.D., Fellow, IEEE	
President	
Beckwith Electric Co., Inc.	
Largo, Florida	
Distribution Volt/Var Control and Smart Grid	
KEYNOTE ADDRESS	85
Joydeep Mitra, Ph.D., Senior Member, IEEE	
Associate Professor	
Electrical Engineering	
Michigan State University	
East Lansing, Michigan	
Energy Assurance in an Age of Variable Generation	

# TECHNICAL PAPERS

High Impact, Low-Frequency Risk Profile Framework	87
Aaron A. Bennett, Member, IEEE	
Software Development Project Leader to the U. S. Army	
Mark G. Lauby, Fellow, IEEE	
Vice President and Director	
Standards	
John N. Moura, Member, IEEE  Manager of Reliability Assessment  North American Electric Reliability Corporation  Atlanta, Georgia	
SmartGrid=??????	95
Don Dumich	
Directof of Commercial & Industrial Application	
S & C Electric Company	
Chicago, Illinois	
Repowered Power Plant Options-	: 8
Current Industry Approaches for Old Steam Plants	
Michael W. Smiarowski, Member, ASME	
Manager, Steam Plant Modernization	
Siemens Energy, Inc.	
Orlando, Florida	
Chair, Turbine, Generator and Auxiliaries Committee, ASME	

The University of Oklahoma Integrated Smart Grid Solution	; 3
Yury Strashnoy	
President & CTO	
PIE Systems International, Inc.	
Los Angeles, California	
Jason Hancock	
Utility Systems Analyst	
The University of Oklahoma	
Norman, Oklahoma	
Chris Greenwell	
Manager, Product Development	
Chris Lee	
Senior Product Innovation Manager	
OG&E	
Oklahoma City, Oklahoma	
T&D Efficiency, End-User Conservation, and Demand Response as Resources	33:
Ward Jewell, Ph.D., Fellow, IEEE	
Professor	
Electrical & Computer Engineering	
Wichita State University	
Wichita, Kansas	
An Application of a Geographical Information Systems Technique in the	346
Estimation of Loop Flows in Wide-Area Electric Power Network with	
High Wind Penetration	
Manish Mohanpurkar	
Ph.D. Candidate	
Colorado State University	
Fort Collins, Colorado	
Hussein Valdiviezo Sogbi	
Graduate Student	
Universidad Autonoma de Yucatan, Mexico	
Siddharth Suryanarayanan, Ph.D.	
Assistant Professor	
Electrical & Computer Engineering	
Site Director, Center for Research and Education in Wind	
Colorado State University	
Fort Collins, Colorado	

Research Investigation and Development of Hybrid Institutional Micro Grid With Optimal Source-Load Modeling	357
E. Chandira Sekaran, Ph.D.	
Associate Professor	
S. R. Sivarasu	
Assistant Professor	
Ph.D. Candidate	
Department of Electrical and Electronics Engineering	
Coimbatore Institute of Technology	
Coimbatore, Tamil Nadu, India	
Impact of Grid Structure on Coherency Identification	368
Di Wu, Ph.D.	
Post-doctoral Research Fellow	
Wei Huang, Ph.D.	
Visiting Research Fellow	
Electric Energy Risk Research Laboratory	
School of Electrical & Computer Engineering	
The University of Oklahoma	
Senior Engineer, Yunnan Power Grid Corporation, China	
Diego Rodriguez Medina	
Graduate Student	
Seyed Hosseini	
Ph.D. Candidate	
John N. Jiang, PH.D., Member, IEEE	
Associate Professor	
Executive Director	
Electric Energy Risk Research Laboratory	
School of Electrical & Computer Engineering	
The University of Oklahoma	
Norman, Oklahoma	

A Kalman Filter Approach to Incorporating Data Analytics in Forecasting	37:
PV Solar Power Availability	
Roy McCann, Ph.D.	
Professor	
The University of Arkansas	
Chief Technology Officer	
LGW Inc.	
Jerome Bute Student St. Augustine's College	
Raleigh, North Carolina	
2012 Summer Research Assistant	
The University of Arkansas	
David Moody	
President	
LGW, Inc.	
Fayetteville, Arkansas	
Impacts of High Penetration Distributed PV Sources on Voltage Regulation and	389
Overview of Control Strtegies	
Vinoth Kumar Ravindran	
Graduate Student	
Visvakumar Aravinthan, Ph.D.	
Assistant Professor	
Ward Jewell, Ph.D., Fellow, IEEE	
Professor	
Site Director Power Systems Engineering Research Center	
Director, Center for Energy Studies	
Electrical & Coomputer Engineering	
Wichita State University	
Wichita, Kansas	
Smoothing of Wind Farm Power Outputs	397
Navin Shenoy	
Ph.D. Candidate	
R. Ramakumar, Ph.D., Fellow, IEEE	
Regents and PSO/Naeter Professor	
Electrical & Computer Engineering	
Director, Engineering Energy Laboratory	
Oklahoma State University	
Stillwater, Oklahoma	

A Comparison of Smart Grid Architectures Around the World  Zeel Maheshwari  Graduate Student	3: 6
R. Ramakumar	
Oklahoma State University	
Stillwater, Oklahoma	
A Study of the Influence of Distribution Automation and Optimal Placement of	3; 9
Distributed Generation and Shunt Capacitors on Voltage Profile and	
Line Losses of Distribution Systems	
Sowmya Nellutla	
Graduate Student	
R. Ramakumar, Ph.D., Fellow, IEEE	
Oklahoma State University	
Stillwater, Oklahoma	
A Study of Transmission Options for the DESERTEC Project	428
Kshitiz S. Byhatti	0
Graduate Student	
R. Ramakumar, Ph.D., Fellow, IEEE	
Oklahoma State University	
Stillwater, Oklahoma	
An Overview of Different Aspects of Smart Grid Networks	437
Ashkan Rashedi	
Graduate Student	
Douglas Jussaume	
Applied Associate Professor	
Kaveh Ashenayi, Ph.D. Senior Member IEEE	
Professor	
Electrical Engineering Department	
The University of Tulsa	
Tulsa, Oklahoma	

Preliminary Study on Recent Large-scale Blackouts: A Work Submitted to IEEE 448 Cascading Failures Task Force

Di Wu, Ph.D.

Post-doctoral Research Fellow

Wei Huang, Ph.D.

Visiting Research Fellow

Electric Energy Risk Research Laboratory

School of Electrical & Computer Engineering

The University of Oklahoma

Senior Engineer, Yunnan Power Grid Corporation, China

Diego Rodriguez Medina

**Graduate Student** 

Seyed Hossein Hosseini

Ph.D. Candidate

John N. Jiang, PH.D., Member, IEEE

**Associate Professor** 

**Executive Director** 

Electric Energy Risk Research Laboratory

School of Electrical & Computer Engineering

The University of Oklahoma

Norman, Oklahoma

A Linear Quadratic Optimization Method in Determining Energy Storage Requirements for Grid Integration of Renewable Electric Power Sources

Roy McCann, Ph.D.

Professor

The University of Arkansas

Chief Technology Officer

LGW, Inc.

Adeline Kamaha

**Graduate Student** 

The University of Arkansas

David Moody

President

LGW, Inc.

хi

459

Dynamic Energy: Is It the Key to Electromagnetic Mass Waves?  Marcus O. Durham, Ph.D., Fellow, IEEE	468		
Senior Principal Engineer			
Robert A. Durham, Ph.D.			
Principal Engineer THEWAY Corp. Tulsa, Oklahoma			
		A Review of IEC 61850 Standard and its Applications in Power Substation	473
		Ashkan Rashedi	
Graduate Student			
Douglas Jussaume			
Applied Associate Professor			
Kaveh Ashenayi, Ph.D. Senior Member IEEE			
Professor			
Electrical Engineering Department			
The University of Tulsa			
Tulsa, Oklahoma			