Physical and Cyber Infrastructure to Support the Future Grid

Unresolved Research Problems and Technology Requirements for the Next 10 Years

May 4-5, 2015
Waterview Conference Center, Arlington, VA

Focus: This event will bring together leaders from industry, academia, and government to identify problems that pose barriers to addressing challenges and taking advantage of opportunities associated with the future grid. Discussions will occur on all research issues associated with physical power systems, and associated information and control technologies. The problems on which this event will focus are those that lend themselves to engineered solutions over the next 5 to 10 years. The solutions are ones that can be achieved through research that produces results that can be put to practical use in that 5 to 10 year time period. This one and one-half day event is organized by Power Systems Engineering Research Center (PSERC) with major funding support from NSF.

Executive Forum on Near-Term Research Needs for the Physical and Cyber Infrastructure that Supports the Future Grid

Monday, May 4th

7:30 am **Registration and Continental Breakfast**

8:30 am **Opening**
Goals and Objectives: Mladen Kezunovic, Chair, Planning Committee (10 minutes)

Welcome: Pramod Khargonekar, Assistant Director, Directorate of Engineering, National Science Foundation (5 minutes)

Terry Boston, PJM

8:45 am **Problems Needing Engineered Solutions over the Next 10 Years**
***Keynote**: Terry Boston, President and CEO, PJM*

9:15 am **Executive Perspectives** *(Moderator: Flora Flygt, Strategic Planning & Policy Advisor, American Transmission Co.)*

H. B. "Trip" Doggett, President and CEO, ERCOT
Bob Mitchell, CEO, Atlantic Wind Connection and Trans-Elect Development Co
Tony Montoya, Executive Vice President and Chief Operating Officer, Western Area Power Administration
A. Wade Smith, President and Chief Operating Officer, AEP Texas

10:30 am **Break**

11:00 am **Technology Application Perspectives** *(Moderator: Mladen Kezunovic, Professor, Texas A&M University)*

Valentine Emesih, Vice President of Grid and Market Operations, CenterPoint Energy
James Gallagher, Executive Director, New York State Smart Grid Consortium
Mark McGranaghan, Vice President of Power Delivery and Utilization, EPRI
David Mohre, Executive Director, Energy & Power Division, National Rural Electric Cooperative Association

12:15 pm **Lunch**

1:15 pm **Technology and Solution Provider Perspectives** *(Moderator: George Gross, Professor, Univ. of Illinois at Urbana-Champaign)*

Jovan Bebic, Managing Director, GE Energy Consulting
Jay Giri, Director, ALSTOM Grid
Ralph Masiello, Innovation Director and Senior Vice President, DNV GL
Gary Rackliffe, Vice President, Smart Grids North America, ABB Inc.

2:30 pm **Government Perspectives** *(Moderator: Jay Caspary, Director, R&D and Special Studies, Southwest Power Pool)*

Chris Greer, Senior Executive, Cyber Physical Systems, NIST Engineering Laboratory
Timothy Heidel, Program Director, Advanced Research Projects Agency-Energy
Pramod Khargonekar, Assistant Director, Directorate of Engineering, National Science Foundation
Jalal Mapar, Director, Resilient Systems Division, Department of Homeland Security
David Ortiz, Deputy Assistant Secretary, Energy Infrastructure Modeling & Analysis, Office of Electricity Delivery and Energy Reliability, U.S. DOE

3:45 pm **Break**

4:00 pm **University and National Lab Perspectives** *(Moderator: Ward Jewell, Professor, Wichita State University)*

Jeffrey Dagle, Chief Electrical Engineer and Team Lead, Electricity Infrastructure / Transmission System Resilience, Pacific Northwest National Laboratory
Iqbal Husain, Director, The Future Renewable Electric Energy Delivery Systems Center, Professor, North Carolina State University
Mark O'Malley, Director, Electricity Research Centre, Professor, University College Dublin
Kevin Tomsovic, Director, Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks, Professor, University of Tennessee-Knoxville
Vijay Vittal, Director, Power Systems Engineering Research Center, Professor, Arizona State University

5:15 pm **Concluding Remarks**

5:30-7:00 pm **Networking Reception**

Workshop on Research to Support Development of the Future Grid

Tuesday, May 5th

7:30 am	Refreshments
8:00 am	Overview of the Broad Research Areas Suggested by the Executive Forum Discussions
8:30 am	Breakouts for Brainstorming Research Questions and Directions Based on the Conversations in the Executive Forum
10:30 am	Break
10:45 am	General Session for Summarizing Discussions in Breakout Sessions
11:45 am	Next Action Steps
Noon	Adjourn

Forum and Workshop Overview

Background: Researchers and research funding agencies need a better understanding of the immediate problems that are barriers to addressing industry challenges and achieving opportunities affecting the future grid. With that knowledge, they will be better able to set research directions and propose research projects over the near-term 5-10 year horizon. Several revolutionary developments are affecting the future grid: smart grid technology innovations, introduction of renewable resources, distributed generation, energy storage, microgrids, and demand-side management programs, among many others. Technology changes include new energy management system functionalities, deployment of distribution management system applications, and expansion of market management system capabilities. In addition, growing use of embedded control infrastructures, such as flexible AC transmission controllers, unified power flow controllers, distribution feeder controllers, and variable-frequency transformers are being proposed. Significant developments are also occurring in Critical Infrastructure Protection (CIP) standardization and enforcement of regulation with an explicit focus on protection of customer privacy, communications, signal processing, computing power, visualization, data management, and other aspects of data processing, storage and user interfacing. Government policy issues and the role of markets add to the challenges and opportunities, and, in some cases, engineered solutions can be help overcome barriers to addressing them.

Objectives of the Executive Form (May 4) and Workshop (May 5): In light of all of the developments affecting the electric power industry, a central question concerns where research can help with finding solutions in the near-term. Specifically, what research can be done to make a tangible difference in the next ten years? An executive forum will be held on May 4 to identify unresolved problems facing industry and government that need to be addressed in the near-term to meet expectations of the grid and of the energy industry in general. The focus will be on those problems with the potential for engineered solutions created by engineers or through interdisciplinary research efforts. Based on the conversations on May 4, the workshop on May 5 will focus on brainstorming research questions and directions with deliverables over the next ten years.

Attendance: Some 100 industry, academic, and government invited panelists and participants will contribute to the conversation about problems, technological requirements, and research needs.

Deliverable: A summary report will be prepared and shared publicly. The report will summarize the researchable problems identified during the executive forum, and will synthesize the research questions and directions discussed during the workshop.

Logistics

Venue

The executive forum and workshop will be held at the Waterview Conference Center located at 1919 North Lynn St., Arlington, VA, 22209. The Center is on the 23rd and 24th floors of the CEB building.

Registration

Registration is closed.

Hotel Accommodations

There are multiple hotel options in the Arlington and Washington DC areas. Easy access to the Metro makes it possible to select from a wide array of possible hotels. Nearby accommodations to the venue are listed on the Waterview Conference Center's website.

Directions and Parking

Driving directions, Metro map, and parking instructions are available on the Waterview Conference Center website.

More Information

For more information about the event, contact Dennis Ray, PSERC Deputy Director, at 608-265-3803 or djray@engr.wisc.edu. For any registration questions, contact Theresa Herr at 480-965-1643 or pserc@asu.edu.

Biographies

Jovan Bebic | GE Energy Consulting

Jovan Bebic joined GE in 2004 and in his current role he supports GE's renewables businesses. His 20-plus years of experience in the power industry have focused on the design and application of high-power converters as well as their interactions with the power system. Dr. Bebic has focused on grid integration of solar energy since 2007, when he led the GE team involved in the Renewable Systems Interconnections Study. Since then, he has participated in all large GE efforts related to solar, including external consulting projects for solar developers and utilities. He also leads the GE team performing system impact and performance evaluation studies on Arizona Public Service's High Penetration Solar Deployment Program, and is the principal investigator on CPUC Solicitation 3 grant quantifying the risk of unintended islanding.

Terry Boston | PJM

Serving as president and chief executive officer since 2008, Mr. Boston oversees the largest power grid in North America and the largest electricity market in the world. Mr. Boston also is president of the Association of Edison Illuminating Companies, Inc., and immediate past president of the GO 15, the association of the world's largest power grid operators. Mr. Boston was recently elected to the National Academy of Engineering, one of the highest professional honors accorded an engineer. He is a member of the Board for the Electric Power Research Institute. He is the past chair of the North American Transmission Forum, dedicated to excellence in performance and sharing industry best practices. He also was one of the eight industry experts selected to direct the North American Reliability Corporation investigation of the August 2003 Northeast/Midwest blackout. Prior to joining PJM, Mr. Boston was the executive vice president of the Tennessee Valley Authority, the nation's largest public power provider. In his 35 years at TVA, Mr. Boston directed divisions in transmission and power operations, pricing, contracts and electric system reliability.

Jeffrey Dagle | Pacific Northwest National Laboratory

Jeffery Dagle is Chief Electrical Engineer and Team Lead, Electricity Infrastructure / Transmission System Resilience at the Pacific Northwest National Laboratory and manages several projects in the areas of transmission reliability and security, including the North American SynchroPhasor Initiative (NASPI) and cyber security reviews for the DOE Smart Grid Investment Grants and Smart Grid Demonstration Projects. He led the data requests and management task for the U.S.-Canada Power System Outage Task Force investigation of the August 14, 2003 blackout, and supported the DOE Infrastructure Security and Energy Restoration Division with on-site assessments in New Orleans following Hurricane Katrina in 2005. Dagle was a member of a National Infrastructure Advisory Council (NIAC) study group that was formed in 2010 to establish critical infrastructure resilience goals. In 2014 he was invited to serve on a National Academy committee to provide recommendations for the analytical research foundations for the next generation electric grid. He received B.S. and M.S. degrees in Electrical Engineering from Washington State University in 1989 and 1994, respectively.

H.B. "Trip" Doggett | ERCOT

H.B. "Trip" Doggett was named president and chief executive officer of the Electric Reliability Council of Texas (ERCOT), in May 2010. Prior to becoming CEO, Mr. Doggett was interim president/CEO and ERCOT's chief operating officer since June 2008. Mr. Doggett has 29 years of experience in the electric power industry, including seven years as an independent consultant in the ERCOT market. He chaired the Texas Nodal Transition Plan Task Force (TPTF) from 2005 to June 2008, and also served as an independent facilitator for the Texas Nodal Team, an ERCOT stakeholder team that developed the ERCOT nodal protocols. Prior to leading the market engagement and readiness team, he was involved in the stakeholder development and implementation of the zonal protocols. Before becoming an independent consultant, Mr. Doggett worked 22 years with Duke Energy in the area of transmission substation engineering and was part of the team that launched the California ISO and PX. Mr. Doggett is a Registered Professional Engineer and earned his bachelor's degree in electrical engineering from the University of North Carolina at Charlotte.

Valentine Emesih | CenterPoint Energy

Valentine Emesih is currently Vice President of Grid and Market Operations at Centerpoint Energy. He is accountable for real-time operations of CenterPoint Energy's electric grid, competitive retail market relations and associated services; design, implementation, deployment and operation of advanced metering back office systems, transmission Energy Management System (EMS), and Advanced Distribution Management Systems – ADMS. He has worked in utility and utility automation business for 27 years. Mr. Emesih, who is licensed Professional Engineer has worked for CenterPoint Energy since 1997. Prior to joining CenterPoint Energy, he held engineering, system development and project management positions for electric utility automation systems vendors – Ferranti International Controls in Sugar Land, Texas (currently Ventyx-ABB); and Johnson Yokogawa Controls/Syseca Inc., in Carrollton, Texas (currently ARINC, Inc.). He earned a Bachelor's and a Master's degree in electrical engineering from The University of Texas at Austin, and Auburn University respectively.

James Gallagher | ARPA-E

James Gallagher is the Executive Director of the New York State Smart Grid Consortium (NYSSGC). As Executive Director, Gallagher oversees the Consortium and its members as they work toward broad statewide implementation of a smart grid to modernize New York's energy infrastructure. Gallagher is a member of the Advisory Board of Grid4EU, the largest smart grid project funded by the European Commission and coordinated by ERDF (Électricité Réseau Distribution France). Comprised of six European energy distributors with a goal of implementing large-scale demonstration projects to showcase advanced smart grid solutions, Gallagher collaborates with international energy and technology experts to learn and create best practices and technological solutions for grid modernization. Gallagher also serves on the EPRI Grid Modernization Advisory Group and sits on the Board of Directors for the Advanced Energy Research and Technology Center. He is co-facilitating the New York Public Service Commission's stakeholder effort on Market Design and Platform Technology in its Reforming the Energy Vision proceeding. He earned a B.S. in Business and Economics from Lehigh University, and an M.S. in Energy Management and Policy from the University of Pennsylvania.

Jay Giri | ALSTOM Grid

Jay Giri is presently Director of Power Systems Technology and Strategic Initiatives at ALSTOM GRID in Redmond, Washington. He leads a team of power system engineers who deliver market applications and synchrophasor phasor measurement unit (PMU) applications to control centers; He is a liaison for university research activities and an affiliate professor at the University of Washington. In 1978, he and 11 other engineers co-founded Energy System Computer Applications (ESCA). In 2010, after numerous mergers and acquisitions, ESCA became part of ALSTOM Grid. Jay designed and implemented the original software for the ESCA automatic generation control (AGC) and dispatcher training simulator (DTS) power system simulation functions. Today the ALSTOM AGC controls over 50% of North American generation as well as generation in many other countries, and the ALSTOM DTS is one of the predominant simulators used by control centers worldwide.

Chris Greer | Cyber Physical Systems, NIST Engineering Laboratory

Chris Greer is Director of the Smart Grid and Cyber-Physical Systems Program Office and National Coordinator for Smart Grid Interoperability. Dr. Greer previously served as Associate Director for Programs in the NIST Information Technology Laboratory (ITL) and Acting Senior Advisor for Cloud Computing. In these positions, he was responsible for strategic planning for information technology initiatives across ITL, including its data and cloud computing efforts. Prior to joining NIST, Chris served as Assistant Director for Information Technology R&D in the White House Office of Science and Technology Policy (OSTP) and Cybersecurity Liaison to the National Security Staff. His responsibilities there included networking and information technology research and development, cybersecurity, and digital scientific data access. He has also served as Director of the National Coordination Office for the Federal Networking and Information Technology Research and Development (NITRD) Program. This program coordinates IT R&D investments across the Federal government, including the cyber-physical systems research portfolio.

Timothy Heidel | ARPA-E

Tim Heidel currently serves as a Program Director at the Advanced Research Projects Agency-Energy (ARPA-E). His focus at ARPA-E includes new approaches for controlling and optimizing the transmission and delivery of electric power, particularly in the context of high renewables penetrations.

Dr. Heidel also manages several programs at ARPA-E focused on high-efficiency power electronics, including new magnetic materials, new capacitor technologies, and wide band gap semiconductor devices. Prior to joining ARPA-E, he was a Postdoctoral Associate at MIT and served as the Research Director for MIT's 2011 "Future of the Electric Grid" study. In that role, he coordinated the research efforts of faculty and students from economics, policy and electrical engineering on the most important challenges and opportunities that are likely to face the U.S. electric grid between now and 2030.

Iqbal Husain | FREEDM, North Carolina State University

Dr. Husain is the Director of the Future Renewable Electric Energy Delivery and Management Systems Center (FREEDM). He joined the ECE department at North Carolina State University as a Distinguished Professor after serving as a faculty member at the University of Akron, Ohio for seventeen years. He obtained his Ph.D. degree in Electrical Engineering from Texas A&M University, College Station, TX in 1993. Dr. Husain's research interests are in the areas of control and modeling of electrical drives, design of electric machines, development of power conditioning circuits, microinverters for distributed power generation, inverter controls for grid synchronization, and modeling of electric and hybrid vehicle systems. He has worked extensively on the development of SR and PM motor drives for various automotive and industrial applications. The research contributions on electric machines are in the areas of design optimizations, sensorless and high performance controls, acoustic noise prediction, and parameter identification methods. The primary application of Dr. Husain's work is in the transportation, automotive, and aerospace industries. As a result of this exposure, Dr. Husain has developed courses for graduate and undergraduate education in electric and hybrid vehicles, and published the textbook *Electric and Hybrid Vehicles: Design Fundamentals*.

Pramod Khargoneker | National Science Foundation

Pramod Khargonekar received B. Tech. Degree in electrical engineering from the Indian Institute of Technology, Bombay, India, in 1977, and M.S. degree in mathematics and Ph.D. degree in electrical engineering from the University of Florida in 1980 and 1981, respectively. Khargonekar was Chairman of the Department of Electrical Engineering and Computer Science from 1997 to 2001 and also held the position of Claude E. Shannon Professor of Engineering Science at The University of Michigan. From 2001 to 2009, he was Dean of the College of Engineering at the University of Florida. He has held the Eckis Professorship in Electrical and Computer Engineering the University of Florida from 2001. He served as Deputy Director of Technology at ARPA-E, U. S. Department of Energy in 2012-13. From March 2013, he has been serving as Assistant Director of the U. S. National Science Foundation leading its Engineering Directorate. Khargonekar's research and teaching interests are centered on theory and applications of systems and control. His early work was on mathematical control theory, specifically focusing on robust and H-infinity control analysis and design. Later, he was involved in a large multidisciplinary project on applications of control and estimation techniques to semiconductor manufacturing. His current research and teaching interests include systems and control theory, machine learning, and applications to smart electric grid and neural engineering.

Jalal Mapar | Department of Homeland Security

Jalal Mapar serves as the Director of the Resilient Systems Division (RSD) at the DHS Science and Technology Directorate (S&T). RSD's mission is to rapidly develop and deliver innovative solutions that enhance the resilience of individuals, communities, and systems by enabling the Whole Community to prevent and protect against threats, mitigate hazards, effectively respond to disasters, and expedite recovery. Previously, as a Program Manager at DHS S&T, Mr. Mapar managed a portfolio of programs that provided a diverse set of technologies to support the nation's emergency preparedness and response mission. His portfolio included several programs including innovative predictive modeling, simulation, and analytics to aid emergency responders in understanding natural or manmade threats to support

preparedness and response operations; training/exercise system to verify and validate response tactics, plans and procedures; first responder location tracking in GPS denied environments and physiological health monitoring technologies; next generation battery technology combined with power management algorithms to enhance mission life of hardware systems; and first responder tools such as the concrete breaching tool for Search and Rescue and Special Operations teams.

Ralph Masiello | DNV GL

Ralph Masiello, Ph.D, DNV GL Innovation Director and Senior Vice President, received his BS, MS, and PhD from the Massachusetts Institute of Technology in Electrical Engineering where he worked on the very early applications of modern control and estimation theory to electric power systems. Currently DNV GL Director for Innovation, he is responsible for Innovation Management within DNV GL including development of an IM practice assisting utilities and energy infrastructure suppliers in developing and managing R&D activities. He has been responsible at DNV GL for bulk power (generation, transmission, and market operations) consulting; for IT systems integration and distribution automation/substation automation, and for telecommunications practices. His personal focus in recent years has been the application of Smart Grid and Electricity Storage technologies to system operations, and the integration of Electric Vehicles with grid operations and markets. He has developed Smart Grid and automation roadmaps for several US ISOs and the California Energy Commission. Dr. Masiello is a Life Fellow of the IEEE and has chairman of the IEEE Power Systems Engineering Committee and serves now on the editorial board of the IEEE Power and Energy Magazine. He is the recipient of the 2009 IEEE Power Engineering Concordia award for Power System Engineering and is a member of the National Academy of Engineering.

Mark McGranaghan | EPRI

Mark McGranaghan is Vice President of Power Delivery and Utilization for the Electric Power Research Institute (EPRI). He leads the teams responsible for EPRI's research involving technologies, systems, and practices for power delivery systems from the generator to the plug and for the devices and technologies that use the electricity. From 2003 to 2010, McGranaghan was Director of Research in the Distribution and Smart Grid areas for EPRI. Priorities during this period were restructuring of the distribution research program, coordinating EPRI research in the smart grid area with government and industry efforts, creating the smart grid demonstration initiative, and increasing the technical strength of the EPRI research team. Prior to joining EPRI, McGranaghan was Vice President at Electrotek Concepts (1998-2003), where he helped develop a new business area around power quality and power system studies into a world leader. From 1978 to 1988 McGranaghan was a Manager at McGraw-Edison/Cooper Power in Canonsburg, Pennsylvania. He managed studies for the utility industry and internal studies for application of McGraw-Edison products (power transformers, circuit breakers, arresters, distribution switchgear, capacitors) and directed a wide range of power system studies.

Bob Mitchell | Atlantic Wind Connection and Trans-Elect Development Co.

Bob Mitchell serves as CEO of Atlantic Wind Connection (AWC), LLC, the transmission backbone that will enable large-scale development of the Mid-Atlantic region's vast offshore wind energy potential. Mr. Mitchell continues serving as CEO of Trans-Elect, America's first independent transmission company that he pioneered with its formation in 1999. Trans-Elect became the lead developer of the AWC in 2009. The Atlantic Wind Connection project was publicly launched in October, 2010, with a front page story in the New York Times and followed by stories in every major news outlet in North America, Europe and Asia. The attention was prompted by the innovation and scale of the $5+ B, ten year project funded by Google, Bregal Energy formerly Good Energy and Marubeni. The Belgian transmission company, Elia, rounded out the equity investors in August of 2011. The Atlantic Wind Connection project is well underway in designing the project, securing regulatory and permitting approvals and is on track to serve the wind developers in Mid-Atlantic region with a super highway for offshore wind that will benefit the environment and rate payers well beyond just the Mid-Atlantic States.

David Mohre | National Rural Electric Cooperative Association

David L. Mohre is Executive Director, Energy & Power Division, National Rural Electric Cooperative Association (NRECA). As Executive Director he is responsible for the division that provides technical,

operational and business analysis for NRECA's regulatory, legislative, research and educational initiatives, as well as direct assistance to members on issues spanning energy markets to end use applications, with specific personal emphasis on FERC regulated wholesale markets, resource adequacy and reliability.

Tony Montoya | Western Area Power Administration

Tony Montoya is Executive Vice President and Chief Operations Officer for Western Area Power Administration. In this position, he provides executive leadership and strategic direction for Westernwide engineering and administrative programs critical to Western's mission. Dr. Montoya previously managed the Power Systems Operations (2002 to 2007), Power Marketing (1996 to 2002), Construction and Engineering (1994 to 1996) and Engineering (1992 to 1994) organizations in Western's Desert Southwest Region in Phoenix. Dr. Montoya is an elected member on the North American Electric Reliability Corporation's Member Representative Committee responsible for advising the North American Electric Reliability Corporation independent Board of Trustees on issues related to Federal and Canadian Provincial utilities. Dr. Montoya's educational background includes a doctorate degree in public administration from Arizona State University, and both master's and bachelor's degrees in engineering from the University of Colorado and Colorado School of Mines. His research interests include regulatory economics, social implications of technology and Flexible AC Transmission Systems.

David Ortiz | U.S. Department of Energy

David Ortiz is Deputy Assistant Secretary for Energy Infrastructure Modeling and Analysis (EIMA) in the Department of Energy's Office of Electricity Delivery and Energy Reliability. The EIMA Division supports cutting-edge research and development that is focused on enabling new ways of delivering and managing electricity for a reliable, secure, resilient, and advanced U.S. energy infrastructure. The Division's activities include advanced modeling and visualization, energy infrastructure risk analyses, reliability assessments, and synchrophasor-based tool development. Prior to joining OE, Dr. Ortiz was a Senior Engineer and Policy Analyst at the RAND Corporation and a professor at the Pardee-RAND Graduate School. At RAND, Dr. Ortiz built a multi-million dollar program of research and analysis in energy technology and policy. David has Ph.D. degree from the University of Michigan in Electrical Engineering in signals and systems, and a B.S.E. degree in Mechanical and Aerospace Engineering from Princeton University. David is a member of IEEE, the IEEE Control Systems Society, and the IEEE Power and Energy Society.

Mark O'Malley | University College Dublin

Mark O'Malley, is the Professor of Electrical Engineering at University College Dublin (UCD). He is the director of the UCD Energy Institute and Electricity Research Centre, a multidisciplinary, multi-institutional, industry-supported research activity. O'Malley is also co-founder of the International Institute for Energy Systems Integration (IESI), a global community of scholars and practitioners engaged in developing an efficient world energy system. He is a Member of the Royal Irish Academy and a Fellow of the Institute of Electrical and Electronic Engineers. He is recognized as a world authority on grid integration of renewable energy and has active research collaborations in Europe, China and the United States, in particular with the National Renewable Energy Laboratory.

Gary Rackliffe | Smart Grids North America, ABB Inc.

Gary Rackliffe is the VP of Smart Grids at ABB. He leads ABB's smart grid initiative in North America which includes business development, alliances and partnerships, strategy, sales, and marketing. He has 30 years of T&D experience, working for ABB in Raleigh the last 20 years. Rackliffe chairs the NEMA Smart Grid Council and is a member of the GridWise Alliance, the DistribuTECH Advisory Committee, and the Research Triangle Cleantech Cluster Advisory Committee.

Wade Smith | AEP Texas

A. Wade Smith is president and chief operating officer for AEP Texas. As president he oversees distribution operations serving more than 900,000 AEP customers in central and north Texas as well as the operating unit's safety, customer services, marketing, communications, community affairs, governmental affairs, and regulatory functions. Previously, he was vice president - Transmission Engineering & Project Services, AEP Transmission, responsible for directing the capital service function in Transmission, with responsibility for Transmission Asset Management, Transmission Projects Engineering and the Project and Construction Management groups. These responsibilities included development of transmission engineering standards, transmission system planning, engineering and design of new or refurbished transmission line and substation facilities, project and construction management, capital cost management, right-of-way/property acquisition, and transmission system maintenance program management. His duties also included the development and application of performance measures and conducting competitive surveillance to evaluate cost effectiveness of asset management and service provider processes and providing direction of strategic and tactical transmission business plans.

Kevin Tomsovic | CURENT, University of Tennessee-Knoxville

Dr. Tomsovic is the Director of the Center for Ultra-Wide-Area Resilient Electric Energy Transmission Networks and the CTI Professor in the Department of Electrical Engineering & Computer Science at the University of Tennessee - Knoxville. He is an IEEE Fellow. He received his B.S. in Electrical Engineering at Michigan Technological University in 1982, and then he received his M.S. and Ph.D. degrees in Electrical Engineering from University of Washington in 1984 and 1987, respectively. He previously was a professor at Washington State University. Dr. Tomsovic's areas of interest include intelligent systems and optimization methodologies applied to various power system problems, including distribution system design, electricity market analysis, equipment diagnostics and maintenance, operation of dispersed energy resources, production scheduling, and stabilization control.

Vijay Vittal | PSERC, Arizona State University

Dr. Vittal is the Director of the Power Systems Engineering Research Center (PSERC) and the Ira A. Fulton Chair Professor in the School of Electrical, Computer and Energy Computer Engineering at Arizona State University. His research interests are in the area of power system dynamics, dynamic security assessment of power systems, power system operation and control, and application of robust control techniques to power systems. He has co-authored two textbooks: *Power System Transient Stability Assessment Using the Transient Energy Function Method* and *Power System Analysis.* He is an IEEE Fellow and was elected to the National Academy of Engineering in 2004. In 2000 he received the IEEE Power Engineering Society Outstanding Power Engineering Educator Award, and the 2013 the IEEE Herman Halperin Transmission and Distribution Field Award. From 1998-2000 he was the Chairman of the IEEE Power Engineering Society System Dynamic Performance Committee. He was the Editor in Chief of the IEEE Transactions on Power Systems from 2005-2011.