Distribution Simulations at Varying Time Scales
Sponsoring Committee: (PSACE) Distribution System Analysis

Session Chair: Kevin Schneider, Pacific Northwest National Laboratory

The majority of traditional distribution simulations have been confined primarily to static power flow simulations, but this is beginning to change as smart grid technologies are increasingly deployed. This panel will examine the new distribution level simulations that are being conducted which include quasi-static time-series simulations and dynamic simulations. These simulations vary from those run at the transmission level because of the inherently unbalanced nature of distribution systems, and the potential for single and double phase laterals. These new simulations will be an essential part of modernizing electric power systems.

Comparison of Distribution-Connected PV Impact Studies: Steady-State and QSTS Hosting Capacity Analysis
Speaker: Barry Mather
Affiliation: NREL

Envisioning Future Distribution Grid with High Penetration of Electrical Vehicles
Speaker: J.K. Wang
Affiliation: OSU

Time-Series Simulations to Evaluate Mitigation Strategies for High Penetrations of PV
Speaker: Jason Fuller
Affiliation: Pacific Northwest National Laboratory

Three-Phase Dynamic Analysis of a Hybrid Transmission and Distribution Model: Impact of PV on Dynamics
Speaker: Jason Bank
Affiliation: EDD

Fault Analysis on Distribution Feeders with High Penetration of PV Systems
Speaker: Mesut Baran
Affiliation: NCSU

Stochastic Modeling and Analysis of Distribution Systems/Microgrids
Sponsoring Committee: (PSACE) Distribution System Analysis

Session Chair: Sarika Khushalani-Solanki, West Virginia University
One often hears system stress, congestion and curtailment with volatility in renewable generation and demand. Transitioning to a sustainable energy future often results in complex and fast aggregated generator and load dynamics, which may lead to severe impact on distribution systems. This transition has forced power system researchers to pay serious attention to their time varying characteristics in a stochastic sense. This panel will identify stochastic models for improving short term and long term performance of smart distribution systems. This panel will focus on data generated by utilities and whether there are approaches to utilize this data in the analysis or designing of data driven approaches.

Predicting Future PV Deployment On Distribution Feeder  
Speaker:  Jens Schoene  
Affiliation:  Enernex

A Study of Fault Detection Thresholds Under Stochastic Conditions Intrinsic to Power Distribution System  
Speaker:  Karen Miu  
Affiliation:  Drexel university  
Panelist:  Karen Miu

Load Frequency Control of microgrid considering uncertainties  
Speaker:  Jignesh Solanki  
Affiliation:  West Virginia University  
Panelist:  Jignesh Solanki

Data-driven methods for distribution system planning and operation based on stochastic smart meter measurement data  
Speaker:  Matthias Stifter  
Affiliation:  Austrian Institute of Technology

Stochastic modeling for grid operation optimization, an application oriented perspective  
Speaker:  Xiaoming Feng  
Affiliation:  ABB

Analysis of Stochastic Solar Generation Behavior on Distribution Systems  
Speaker:  Tom McDermott  
Affiliation:  University of Pittsburgh  
Panelist:  Tom McDermott

Measurements and Their Integration Challenges for Distribution State Estimation  
Sponsoring Committee:  (PSACE) Distribution System Analysis

Session Chair:  Liuxi (Calvin) Zhang, Nexant, Inc.

Traditionally, very few state estimators have been implemented in distribution systems mainly due to lack of measurement redundancy. Recently, the increasing deployment of different measurements in the distribution level, such as distribution SCADA, AMI and PMU, makes it
feasible to develop and deploy more advanced distribution state estimator (DSE) to enable the situation awareness of distribution systems. However, how to integrate these different measurements from different resources with various qualities becomes a major challenge for DSE. This panel will examine the state-of-art of the measurement availability in the utility companies and discuss the cutting edge research and implementation technique to address this issue. The results are expected to aid academic researchers and practicing engineers in future development of DSE.

Meter placement for state estimation on distribution feeders
Speaker: Mesut Baran
Affiliation: NCSU

Lessons Learned in the Real World Regarding Distribution State Estimation
Speaker: Anthony Johnson
Affiliation: SCE

Impact of ICT infrastructure in measurement for distribution system state estimation
Speaker: Bikash Pal
Affiliation: Imperial College

Requirements for Distribution State Estimation for Quasi-Static Time Series Analysis of Distribution Network
Speaker: Mehmet Celik
Affiliation: U.S. Department of Energy

New Modeling and Analysis Approaches for the Integration of Distribution System Measurements
Speaker: Hao Zhu
Affiliation: UIUC

Improving distribution system control through better distribution state estimation
Speaker: Xiaoming Feng
Affiliation: ABB

Challenges to Operate a Large Transmission Grid with Minimal or No Connected Synchronous Generators - Going Towards 100% Penetration of Power Electronics-Interfaced Generation
Sponsoring Committee: Power System Dynamic Performance

Session Chair: Evangelos Farantatos, Electric Power Research Institute
Session Chair: Patrick Panciatici, RTE

The rapid expansion of Power Electronics (PE) interfaced renewable resources (mainly wind/solar) will change the way transmission systems are designed and operated. Since the physical properties and limitations of converters are very different compared to the ones of synchronous generators, an evolution of today’s protection and control strategies might be necessary and in the case of a network operated only with
resources interfaced through PE, new schemes might be needed. In the near future, some control zones in large transmission systems (for example in Europe) will be operated most of the time with extremely high penetration levels of PE interfaced generators. In that case it should be considered that, due to unexpected events or an unintentional operation, part of the transmission system only fed by PE interfaced generation, might isolate from the rest of the grid thus the PE converters will need to be able to operate autonomously.

Protection and Control Considerations for Future Grid Scenarios  
Speaker: Evangelos Farantatos  
Affiliation: Electric Power Research Institute  
Panelist: Evangelos Farantatos

From Inertia to Synchrony  
Speaker: Thibault Prevost  
Affiliation: RTE  
Panelist: Thibault Prevost

TenneT - EU Horizon2020 Massive Integration of Power Electronic Devices  
Speaker: Mart van der Meijden  
Affiliation: TenneT TSO B.V.  
Panelist: Mart van der Meijden

Transitioning from Grid-Following to Grid-Forming Control Strategies  
Speaker: Brian Johnson  
Affiliation: NREL

Dynamic Performance of an All Converter Interfaced Generation WECC System  
Speaker: Vijay Vittal  
Affiliation: Arizona State University  
Panelist: Vijay Vittal

Protection and Control Issues in Systems with Converter Interfaced Generation  
Speaker: Sakis Meliopoulos  
Affiliation: Georgia Tech  
Panelist: Sakis Meliopoulos

New Control Strategies for Improving Robustness against Grid Stiffness  
Speaker: Xavier Guillaud  
Affiliation: EC Lille  
Panelist: Xavier Guillaud

Modeling and Stability Analysis of Large-scale AC-DC Systems: North American Perspective  
Sponsoring Committee: Power System Dynamic Performance

Session Chair: Nilanjan Ray Chaudhuri, North Dakota State University

Session Chair: Rajat Majumder, SIEMENS PTI
Modular multi-level converters (MMCs) are now the de-facto standard topology for VSC HVDC systems. Stability models for MMC based VSC HVDC systems which is “simple yet accurate” for incorporation into large-scale AC system models has to be standardized. This will be useful in studying AC/DC system stability, provision of ancillary services (e.g. frequency regulation, inertial support through AC line emulation) and potential interactions. It is important for the utilities and/or ISOs to study and ascertain the impact of growing number of MMC DC links (or DC grids envisaged in future in Europe) connected to their system. Cigre WG B4-57 and WECC HVDC modeling task force is working on this topic. The objective of this panel is to delve deeper into this subject, taking into account a North American perspective and solicit the views of experts from the ISOs, manufacturers, research institutes and academia.

HVDC modeling for stability and powerflow studies in large electric power systems: a WECC TF effort  
Speaker: Pouyan Pourbeik  
Affiliation: EPRI

The Emergence of Complete Direct Current Electric Power Infrastructure for T&D Applications and Microgrid Developments  
Speaker: Gregory Reed  
Affiliation: University of Pittsburgh

Designing Self-Contingent HVDC Systems with the AC Systems  
Speaker: Dale Osborn  
Affiliation: MISO

Modeling Adequacy Study of MMC-HVDC Embedded in AC Systems  
Speaker: Nilanjan Ray Chaudhuri  
Affiliation: North Dakota State University

Improvement of System Dynamic Performance Through Application of STATCOM Technologies  
Speaker: Don Shoup  
Affiliation: Mitsubishi Electric Power Products, Inc.

Transformer Resiliency and Physical Security  
Sponsoring Committee: Transformers


The loss of a key transmission or generator transformer, whether due to natural or man-made events, can cause a loss of significant power to the grid. This loss of power could cause cascading effects resulting in long-term outages. Several programs have been put into place to mitigate this risk. We will present two of these programs. This presentation will:  
• Explain how the grid is susceptible to prolonged outages by the loss of key transformers. 
• Describe how the STEP program established a pool of transformers, maintained by participants in the program, which can be made available for purchase should a transformer suffer a “triggering event”. Further the definition of ‘triggering event’ and the rules for participation will be described.
• Describe what a Recovery Transformer is as defined by the Department of Homeland Security. To further explain how this transformer was designed and deployed as demonstrated by the pilot demonstration.

Identification of laboratory Methods to support on-line undergraduate power engineering education
Sponsoring Committee: Power & Energy Education

Session Chair: George Karady, Arizona State University

Several universities in the world are offering online undergraduate engineering degree (BS), which requires laboratory exercises. The objective of this panel session is to identify suitable methods for laboratory exercise to students working on-line for undergraduate BS degree in Power. Cursory literature survey identifies several possible solutions including a cloud server based online laboratory for power engineering program, Virtual Lab, a high speed microprocessor programming based automation and control laboratory and the short time visit in real laboratory. The invited five panelists will present their solution and the discussion will identify the most desirable methods.

Simulink powered virtual laboratory for electric machines.
Speaker: George Karady
Affiliation: Arizona State University
Panelist: J.Yu

Introduction of Emerging Technologies to Distribution System Education via Simulation
Speaker: Anthony Deese
Affiliation: The College of New Jersey (TCNJ)
Panelist: Valentina Cecchi, University of Carolina at Charlotte

Functional Microgrids Using Electromechanical Machines in a Laboratory for Undergraduate Education
Speaker: Badrul Chowdhury
Affiliation: University of North Carolina-Charlotte

Virtual laboratory, a new paradigm in learning.
Speaker: Praveen Kumar
Affiliation: Indian Institute of Technology Guwahati

IEEE P1876™ Standard for Networked Smart Learning Objects for Online Laboratories
Speaker: Hamadou Saliah-Hassane
Affiliation: TELUQ - University of Quebec
Integrating Synchrophasor Research into Education
Sponsoring Committee: Power & Energy Education

Session Chair: Anurag Srivastava, Washington State University

Use of synchrophasor data from Phasor Measurement Units (PMUs) is critical for situational awareness and decision support to operate modern electric power systems. Synchrophasor data helps to identify and respond to deteriorating or abnormal grid conditions much quickly. Synchrophasor technologies are being adopted in electric grid operation but only a limited number of professionals, researchers, and students have the knowledge and expertise to understand and analyze the high-speed, time-synchronized data. US Department of Energy (USDOE) supported number of synchrophasors engineering education projects starting in 2013, which were completed or will be completed by end of 2015. These projects helped in accessing data provided by utility collaborators and to create an opportunity for academic institutions to collaborate with other stakeholders to expand the graduate and undergraduate engineering curricula by integrating research into education. This panel will focus on highlighting educational material developed as part of these projects.

DOE Synchrophasor Engineering Education
Speaker: Philip Overholt
Affiliation: US Department of Energy

ExoGENI-WAMS: A Testbed for Wide-Area Monitoring and Control of Power Systems using Distributed Cloud Computing
Speaker: Aranya Chakraborty
Affiliation: NC State University

Academic and Industrial Educational Synchrophasor Development Program at Texas Tech University
Speaker: Stephen Bayne
Affiliation: Texas Tech University
Panelist: Michael Giesselmann, Andy Swift, Mark Harral

The development of an inter-disciplinary power program through academic-industry collaborations
Speaker: Dongliang Duan
Affiliation: University of Wyoming
Panelist: John Pierre (University of Wyoming), Suresh Muknahallipatna (University of Wyoming), Dan Trudnowski (Montana Tech), Matt Donnelley (Montana Tech), Liuqing Yang (Colorado State University)

IIT-Industry Collaboration: Synchrophasor Engineering Research and Training
Speaker: Alex Flueck
Affiliation: Illinois Institute of Technology

Situational Intelligence Through the Eyes of Synchrophasors
Speaker: G. G. Kumar Venayagamoorthy
Innovations in curriculum development, course delivery and multi-institutional collaborations are much desired to meet increasing demands in smart grid education and to better align academic research with utility efforts in renewable deployment. The DoE SunShot GEARED program aims to increase capacity of power engineering programs, and it supports collaborations among universities, electric utilities and industry. As a result, multi-institutional course sharing agreements have been developed, and collaborative course offerings have been undertaken. The goal of this panel session is to understand benefits and obstacles of these multi-institutional efforts, share pedagogical innovations and best practices, and enhance future endeavors. In particular, the topics include: overview of DoE GEARED program, on-going activities at three GEARED consortia, key components of multi-university course sharing agreements, curriculum trends, distance and mixed learning/delivery modes, roles of DoE/utility supports, and impacts. Panelists are from DoE, academia, national laboratories, and utility.
Electric power and energy engineering is driven by growth, policy, economics, and new engineering ideas. The latter driver, namely the new ideas, is actually elements of research in engineering. This panel deals with the general topic of long term innovative topics for research in electric power engineering.

Some engineering ideas are in the short term and these might be characterized as implementation and commercialization of well understood existing technologies. Other ideas are some-what longer in their inherent time frame, and these might be termed ideas for development. Still longer term concepts fall into an area that may be high risk, may be controversial, and may have potentially problematic commercialization. These latter high risk ideas may have concomitant high impact and long lasting influence. This panel is an overview of very innovative research topics in electric power and energy engineering, and these are the topics that fall into the latter category of long term concepts in this field.

An overview of long term, potentially high risk, innovative research topics in electric power engineering
Speaker: G. Heydt
Affiliation: ASU

A high frequency, half-wavelength power transmission scheme
Speaker: Wilsun Xu
Affiliation: University of Alberta
The United States Energy Information Administration predicts a 21% increase in residential electricity use from a 2012 reference case to the year 2040. Studies show that small and targeted reductions in peak demand can have large impacts on wholesale electricity prices. Given that residential customers can account for over half of the system peak demand in summertime in markets like the Electric Reliability Council of Texas (ERCOT), residential demand response (DR) programs are attractive solutions for relieving the stress on the system and market. In order to quantify the impact and effectiveness of residential DR in the system, we need new simulation tools that can model the various end-user assets and integrate them seamlessly with environments for studying grid-level systems. In this panel, we will assemble experts in the area of modeling end-user assets and controls for educating the audience on the state-of-the-art.

An overview of the need for modeling the end-user in CPS-based simulation studies in power engineering
Speaker: Siddharth Suryanarayanan
Affiliation: Colorado State University

Customer modeling in smart electric distribution grids
Speaker: Timothy Hansen
Affiliation: South Dakota State University
Including consumer asset models in power systems analysis  
Speaker: Annabelle Pratt  
Affiliation: NREL

A test bed to experiment and demonstrate the advanced control strategies for managing energy usage in buildings  
Speaker: Siddharth Goyal  
Affiliation: Pacific Northwest National Laboratory

Scheduling and controlling building power consumption to provide ancillary services  
Speaker: Johanna Mathieu  
Affiliation: University of Michigan

**Transformation to a Resilient Grid: From Research Philosophy to Multidisciplinary Education**  
**Sponsoring Committee: Power & Energy Education**

Session Chair: Brian Johnson, University of Idaho

The evolution of automation to control infrastructures for greater safety and energy efficiency has achieved a complex environment where cyber-attacks, human error, or damaging storms can wreak havoc on the infrastructures. Future systems need to consider the broader picture to ensure failures do not lead to catastrophic events. The students of tomorrow who will be expected to advance these designs are a critical resource, and require both a perspective on these challenges and the multidisciplinary challenges. Efforts in the arena of resilience have demonstrated need to address technological challenges. However, challenges of multidisciplinary design efforts have also become evident. To shift from isolated disciplinary efforts to a multidisciplinary “common language,” these challenges need to be addressed, along with acknowledging contributions from each discipline. This panel session will overview resilience from its underlying attributes and provide a basis for educational designs that have been used to provide multidisciplinary learning.

Adapting Governance and Economic Incentives for Advancing Resilience  
Speaker: Stephen Flynn  
Affiliation: Northeastern University

Definition/Areas of Resilience, Resilience Metrics  
Speaker: Craig Rieger  
Affiliation: Idaho National Laboratory

The Cyber Perspective on Resilience and Cyber Feedback  
Speaker: Marco Carvalho  
Affiliation: Florida Institute of Technology
Modern power systems increasingly operate at lower security margins, due to reduced regulation capability resulting from increased variable generation, increased transmission loading, and market operations. Concomitantly, the ongoing deployment of new communication, computing and control technologies has significantly augmented the capabilities of traditional SCADA systems. These developments have generated both the need and the potential for performing stability analysis of large-scale systems at real-time speed. In recent years there have been significant advances both in the mathematical development of direct methods (based on Lyapunov functions) for transient stability analysis, as well as their application in developing real-time screening tools for dynamic contingencies. This panel will discuss some of these advancements, including semidefinite programming approaches, CUEP-based and homotopy-based methods, as well as real-life applications of on-line contingency screening, preventive control and remedial action. Presenters include well-known researchers and practitioners from academia and industry.

Construction of Transient Stability Certificates Based on Semidefinite Programming Approaches: Challenges and Opportunities
Speaker: Konstantin Turitsyn
Affiliation: Massachusetts Institute of Technology

CUEP-based Enhancement Control for Transient Stability: Theory, Design and Numerical Studies
Speaker: Hsiao-Dong Chiang
Affiliation: Cornell University

Study of Application of Direct Methods as a Screening Tool for On-line Stability Analysis
Speaker: Jianzhong Tong
Affiliation: PJM Interconnection
The power sector has been regarded as the most important source for carbon and pollutant emissions control. Environmental regulations are typically put in place to either incentivize the use of renewable resources or discourage the use of fossil resources that do not have the appropriate retrofits to limit pollutants. The purpose of this session is to discuss relevant environmental regulations in different areas of the world and document impacts on power market design, equilibrium analysis and operation economics. The session will focus on:

1) How to model different regulation elements and their impacts on power markets?

2) How these regulations impact long-term resource investment and demand-supply adequacy?

3) How these regulations impact market equilibrium?

4) How these regulations impact the provision of ancillary services?

5) How to evaluate the economics resulting from these regulations?

6) How to design effective mechanisms to address these problems?

Environmental Impacts on Power Market and Power System Operations
Speaker:  Qixin Chen, Tsinghua University, China
Affiliation:  Tsinghua University, China
Panelist:  Qixin Chen

Impact of Environmental Regulations and Renewable Resources on the Power Market Design
Speaker:  Alex Papalexopoulos, ECCO international
Affiliation:  ECCO international

Renewables integration challenges under zonal market model
Speaker:  Robert Paprocki, PSE - Polish transmission system operator
Affiliation:  PSE - Polish transmission system operator

Incompatibility between power system's environmental regulations and market designs
Speaker:  Yang Yu
Proliferation of renewable create system operational problems due to variability and relative unpredictability of these resources. The immediate consequences are the need for increased levels of conventional reserves and emergence of new grid services such as Flexible Ramping, Load Following, and Up/Down Balancing Energy reserves. Some organized markets have embarked upon incorporating such new services in their market design. However, the pricing, payment, and cost allocation for the new grid services are not necessarily aligned with those for conventional Ancillary Services. This panel session will explore ongoing efforts for definition and incorporation of new grid services in organized and bilateral markets, issues related to interplay between conventional and new grid services, and incentive compatible alignment of pricing, payment, and cost allocation for new and conventional reserves.

Integrated Grid – Distribution and Transmission, Retail and Bulk Power Markets
Speaker: Ali Ipakchi
Affiliation: OATI
Panelist: Ali Ipakchi

Electricity-Natural Gas Operation Planning with Hourly Demand Response for Deployment of Flexible Ramping
Speaker: Mohammad Shahidehpour
Affiliation: IIT
Panelist: Mohammad Shahidehpour

California Market Designs for Grid Services to Integrate Renewable Energy Portfolios
Speaker: Jim Price
Affiliation: California ISO
Panelist: Jim Price

Stability in Market Design; The intersection of economics and control systems
Speaker: Ralph Masiello
Affiliation: Quanta Technology
Panelist: Ralph Masiello

Approaches to Reduce Energy and Ancillary Services Uplift and PJM Experiences
Speaker: Ying Xiao
The Polar Vortex of winter 2013/14 revealed problems that can occur when certain generators can only manage their limited fuel supplies with the standard bidding and optimization processes available in the markets today. Limited-energy resources may include pumped storage hydro, run-of-river hydro with limited ponding, generation with limited on-site oil reserves, and gas-fired generators on critical winter days. This session with a mix of Industry, ISO/RTO, and Research Institution panelists will focus on new market construct developments for these energy-constrained resources to increase market efficiency and reliability.

Speaker: George Gross
Affiliation: U of Illinois

Operation of Energy-Limited Resources in the ISO Markets
Speaker: Cuong Nguyen
Affiliation: New York Independent System Operator

Operation of Energy-Limited Resources in the ISO Markets
Speaker: Tongxin Zheng
Affiliation: ISO New England

Interdependency of Constrained Natural Gas and Electricity for Variable Energy Scheduling
Speaker: Mohammad Shahidehpour
Affiliation: IIT

The role of energy storage in electricity markets
Speaker: Audun Botterud
Affiliation: Argonne National Laboratory

Flexible Demand, Scheduling and its Economic Impacts on the Markets and System Operation
Sponsoring Committee: PSO: Electricity Market Economics Subcommittee

Session Chair: Miguel Ortega-Vazquez, University of Washington
Power system's flexibility is largely served by the supply side of power systems. However, with the advent of two-way communications and other ways to interact with the consumers under the smart grid paradigm, the demand side is gaining higher degrees of control and flexibility. Large ensembles of flexible loads could be used by system operators to provide a share of the ancillary services and flexibility requirements. This panel will explore: 1) the mechanisms for the co-optimization of conventional sources and unconventional sources of flexibility (e.g., demand side), 2) the coordination to provide a share of these services, and 3) the implications for market and system performance.

Estimating and Controlling Demand Flexibility Potential: Some Answers
Speaker: François Bouffard
Affiliation: McGill University
Panelist: François Bouffard, Amir Abiri-Jahromi

The Role of Operational Flexibility for Power System Performance
Speaker: Andreas Ulbig
Affiliation: ETH Zurich
Panelist: Andreas Ulbig, Göran Andersson

Harnessing demand-side flexibility through Transactive control and coordination
Speaker: Ron Melton
Affiliation: Pacific Northwest National Laboratory
Panelist: Ron Melton

Aggregated operation of flexible appliances as a system resource
Speaker: Anna Scaglione
Affiliation: Arizona State University
Panelist: Anna Scaglione

Stochastic Methods for Power System Modelling, Control and Optimization
Sponsoring Committee: PSO: Operation Methods Subcommittee

Session Chair: Federico Milano, University College Dublin
Session Chair: Chris Dent, Durham University

This panel covers the current state of the applications of stochastic methods for power system analysis and operation. After an overview talk that provides an outline of the topics to be covered in the panel, a survey of existing application of stochastic methods will be given. Different time scales will be discussed in the panel, as follows. The adequacy of stochastic differential equations to model short term phenomena, such as wind speed variations will be discussed under two different points of view, namely, forecasting and dynamic analysis. Then the potential of long-term optimization models based on stochastic programming will be illustrated through some specific applications to
Using emulation to quantify uncertainty in energy system models
Speaker: Amy Wilson
Affiliation: Durham University

RESGen: Renewable Energy Scenario Generation Platform
Speaker: Pierre Pinson
Affiliation: DTU

Distribution system planning for uncertain DER futures using Adaptive Dynamic Programming (ADP)
Speaker: Brian Palmintier
Affiliation: NREL

SDE-based Wind Speed Models with Weibull Distribution and Exponential Autocorrelation
Speaker: Rafael Zarate-Minano
Affiliation: Univ. Castilla - La Mancha

Stochastic approaches for reserve determination and operational planning
Speaker: Eamonn Lannoye
Affiliation: EPRI

Cloud Computing - trend and security and implementation experience in power system operations
Sponsoring Committee: PSO: Operation Methods Subcommittee

Session Chair: Xiaochuan Luo, ISO New England Inc
Session Chair: Lian Min, Lawrence Livermore National Lab

Cloud computing provides a new paradigm for access to larger scale computing resources over the Internet, thus offering an alternative solution to big data processing and heavy computational work. Cloud computing delivers infrastructure, platform, and software as subscription-based services in a pay-as-you-go model to consumers. The technology is evolving fast with companies of all shapes and sizes adapting to it and the trend will continue to grow in the future. However the power industry is relatively conservative and has become one of the few industries where cloud computing has not yet been adopted. This panel serves as a forum for the regulating entities, cloud vendors, academia and the power industry to discuss the future trend of the cloud computing, all the concerns including data security and privacy, compliance audit, NERC CIP, etc, and the experience and lessons learned from a few implementations in power systems

Trend and Security of Cloud Computing
The electric distribution system is undergoing a fundamental transformation to deal with integration of Distributed Energy Resources (DER) and microgrids to enhance efficiency, reliability and resiliency objectives. To that end, many states are enacting and implementing policies to promote the application of renewable and distributed energy. The proliferation of DERs and microgrids create technical and energy market issues which demand the creation of new constructs and approaches for the management of distribution operation and electricity market transactions at the distribution level. This panel session provides an overview of the challenges and opportunities associated with the integration of DERs and microgrids and the necessary evolution of the distribution system to respond to such challenges.

Microgrids for Enhancing Economics, Reliability, and Resilience
Power system state estimation (SE) has been a critical function in energy management systems and energy markets around the world. An SE model is developed under several assumptions such as, balanced three-phase system, known system topology, network equipment models based on certain assumptions, no time-skew between measurements, zero-mean measurement errors following ideal probability distribution, to name a few. These assumptions are partially satisfied in practice. Changes in network topology, meter calibrations, equipment parameters are some examples where the assumption are not held over time. For convenience of implementation and maintenance of topology certain assumptions are made as well. The panel experts from academia and industry discuss current practices focusing on SE accuracy, robustness to bad data and numerical solution quality under violations of some of the assumptions. It also brings in some of the important progresses made around the world for overall benefit of the industry

Developmental efforts in state estimation accuracy and robustness: the experience of Union Fenosa Distribucion
Speaker: Antonio Gomez-Exposito
Microgrid Stability and Modeling  
**Sponsoring Committee: Power System Dynamic Performance**

**Session Chair:** Claudio Canizares, University of Waterloo

Microgrids present some unique characteristics, compared to transmission systems, associated with their distribution voltage levels and generation equipment, such as unbalanced operation, low X/R ratio that couples P and Q, inverter-based generation and storage, low inertia, limited voltage control, and the significant effect of generation and load variations on its operation. These particular issues have a significant impact on the stability of microgrids, especially at the moment of connection to and when disconnected from a main grid, presenting new and especial modeling and analysis challenges that need to be better qualified and quantified. This panel will concentrate on discussing various relevant issues on microgrid stability modeling, analysis, and tools, including a review of the state-of-the-art, highlighting shortcomings of existing concepts,
techniques and models, and presenting new approaches to better understand, define, and study stability issues in microgrids.

Microgrid in Remote Communities—Technical Challenges
Speaker: Ehsan Nasr
Affiliation: Canadian Solar

Modeling Methods for Microgrid Stability Analysis
Speaker: Lingling Fan
Affiliation: University of South Florida

Synthetic Inertia on Power Systems: a review of the main applications and findings
Speaker: Reinaldo Tonkoski
Affiliation: South Dakota State University

Impedance based stability analysis in Microgrids
Speaker: Patricio Mendoza-Araya
Affiliation: University of Chile

Need for New Approaches to Modeling Switching Power Electronics for Microgrid and their Impact on New Stability Analysis and Control Approaches
Speaker: Sudip Mazumder
Affiliation: University of Illinois

Voltage and Frequency Stability in Remote Islanded Microgrids with High Penetration of Renewables and Unbalanced Loading
Speaker: Richard Wies
Affiliation: University of Alaska

Stability Impact and Control of Unbalancing and Frequency Variations in Microgrids
Speaker: Claudio Canizares
Affiliation: University of Waterloo

Advancements in Load Modeling for Dynamic Voltage Performance Analysis
Sponsoring Committee: Power System Dynamic Performance

Session Chair: Baj Agrawal, Arizona Public Service

Session Chair: Venkataramana Ajjarapu, Iowa State University

Proper representation of electrical loads in power system studies is very important, as loads play an ever increasing role in power system dynamic stability, especially voltage stability and Fault Induced Delayed Voltage Recovery (FIDVR). FIDVR is a phenomenon when the power system voltages remain at substantially reduced levels several seconds after transmission fault is cleared due to stalling of motor loads. FIDVR events have been observed in Southern California, Arizona, Texas, Florida and the south eastern part of US. This panel discusses on going latest research in
load modeling and dynamic behavior of loads, characterization of FIDVR phenomena, and Industry experience in FIDVR.

**Latest Research on Load Modeling and Dynamic Behavior of Loads**
Speaker: Pouyan Pourbeik  
Affiliation: EPRI

**Phase II Load Modeling Work**
Speaker: Dmitry kosterev  
Affiliation: Bonaville Power Administration

**Hybrid Time Domain Simulation: Application to FIDVR**
Speaker: Vijay Vittal  
Affiliation: Arizona State University

**Application of Composit Load Models for FIDVR Studies in Entergy System**
Speaker: Sharma Kolluri  
Affiliation: Entergy Corporation

**SCE Experience with FIDVR**
Speaker: Jun Wen  
Affiliation: Southern California Edison

**Southern Company's Experience with Load Model**
Speaker: Shin-Min Hsu  
Affiliation: Southern Co.

**Characterization of FIDVR Phenomena and Dynamic Voltage Control Areas to Mitigate FIDVR**
Speaker: Venkataramana Ajjarapu  
Affiliation: Iowa State University

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**Global Best Practices on Natural Disaster Mitigation: Operation Technologies, Communication, and New Trends**

**Sponsoring Committee: Power System Operations**

Session Chair: Jianwei (Jay) Liu, PJM Interconnection LLC

In responding to natural disasters, electric utilities have developed comprehensive plans for emergency preparation, incident response structure and procedures, service restoration process, and evaluation matrices during and after events. Response plans are gradually developed based on field experience starting from the emerging of modern power grids. New technologies in smart grid and asset management have shown great advantages on natural disaster mitigation. Communication plays the key role throughout the mitigation efforts, ranging from internal information flow on disaster evaluation, asset allocation, and decision making, to awareness in publicity domain. Pre- and post-event scenario analysis presents the nature of best practices and discover knowledge and lessons-learned from real world events. In this panel, best practices of natural disaster mitigation around the world will be discussed, with the
focus on the evolution of Operation Technology, Data and Communication, and role of new technologies.

Disaster Management Down Under - 3 P's
Speaker: Simon Bartlett
Affiliation: University of Queensland
Panelist: Simon Bartlett

Lessons-learned from 921 Earthquake in Taiwan 1999
Speaker: Nanming Chen
Affiliation: National Taiwan University of Science and Technology
Panelist: Nanming Chen

Planning Criteria Adequacy to Deal with Natural Disasters & Other Threats
Speaker: Kamran Ali
Affiliation: American Electric Power
Panelist: Kamran Ali

Modern Power Grid Operation Strategies and Preparation under Natural Disasters
Speaker: Zhiwei Wang
Affiliation: SGRI North America Inc.
Panelist: Zhiwei Wang

Optimal system restoration response considering critical infrastructure interdependencies
Speaker: Jose Marti
Affiliation: The University of British Columbia
Panelist: Prof. Jose R. Marti

Framework of Natural Disaster Impact Identification and Mitigation Matrices: Task Force Updates
Speaker: Jianwei (Jay) Liu
Affiliation: PJM Interconnection LLC
Panelist: Jay Liu, Le Xu

Best Practices in Real-Time Monitoring and Analysis Capabilities in Control Centers
Sponsoring Committee: PSO: System Operation & Control Centers Subcommittee
Session Chair: Saad Malik, PEAK Reliability

Session Chair: Mark Olson, NERC

NERC is working on developing standards for Real-time Reliability Monitoring and Analysis Capabilities in Control Centers. The project referred to as ‘Project 2009-02 Real-time Reliability Monitoring and Analysis Capabilities’ was initiated in response to work done by the NERC Operating Committee's Real-time Tools Best Practices Task Force (RTBPTF). In recent years, owners and operators of the North American bulk electric system have adopted many reliability standards designed to improve
operator awareness of system conditions. The Project 2009-02 is
developing requirements for the real-time capabilities used by
Reliability Coordinators, Transmission Operators and Balancing
Authorities in support of reliable system operations. The standards
developed under this project address many industry recommendations and
lessons-learned from significant Bulk Electric System (BES) events, as
well as regulatory directives. This panel shall present the standards
developed in this project and best practices in Real-Time Monitoring and
Analysis Capabilities in Control Centers.

Project 2009-02 Real-time Reliability Monitoring and Analysis
Capabilities
Speaker: Mark Olson
Affiliation: NERC
Panelist: Mark Olson, Saad Malik, Sarma Nuthalapati, Robert Staton

Best Practices of monitoring data quality for Real-Time Monitoring and
Analysis in Control Centers
Speaker: Saad Malik
Affiliation: PEAK Reliability
Panelist: Mark Olson, Saad Malik, Sarma Nuthalapati, Robert Staton

Best Practices of monitoring tools for Real-Time Monitoring and Analysis in Control Centers
Speaker: Sarma Nuthalapati
Affiliation: ERCOT
Panelist: Mark Olson, Saad Malik, Sarma Nuthalapati, Robert Staton

Best Practices of monitoring alarming systems for Real-Time Monitoring and Analysis in Control Center
Speaker: Robert Staton
Affiliation: Xcel Energy
Panelist: Saad Malik, Mark Olson, Sarma Nuthalapati, Robert Staton

Enhancing Interoperability between DSOs and TSOs
Sponsoring Committee: PSO: System Operation & Control Centers
Subcommittee

Session Chair: Martin Braun, Fraunhofer IWES

Session Chair: Gareth Taylor, Brunel University London

Due to the increase of distributed generation in the distribution system
there is a need to operate the distribution system more actively.
Complying system responsibility of the TSO depends more and more on the
distribution system. Interoperability between DSOs and TSOs becomes of
outmost importance. This includes:

- Ancillary Services from DSOs to TSOs
- Coordinated Outage Planning and System Restoration
- Information Exchange and Data Management
- Coordinated System planning
- Integration of RES

Challenges and Opportunities in Enhanced TSO-DSO Coordination
Speaker:  David SUN
Affiliation:  Alstom

Speaker:  Christian D'Adamo
Affiliation:  ENEL

Ancillary Services from DSO to TSO - Pilot Project and Real-Time Simulation Environment
Speaker:  Martin Braun
Affiliation:  Fraunhofer IWES

Justification of Business Process Change to Enable Higher Levels of TSO-DSO Interaction
Speaker:  Gareth Taylor
Affiliation:  Brunel University

Information Exchange and Application Function Coordination Among DSOs and TSOs
Speaker:  Guangyi Liu
Affiliation:  State Grid EPRI

Role of Modeling in achieving an Active Transmission and Distribution System Interface
Speaker:  Jason Taylor
Affiliation:  EPRI

Robustness and consistency of security assessment applications for Real-time Operations
Sponsoring Committee:  PSO: System Operation & Control Centers Subcommittee

Session Chair:  Ziwen Yao, bchydro

Robustness and consistency are two of the critical requirements for security assessment applications, such as CA, TSA, VSA used in real-time operations (RTO). More and more control centers have installed advanced security assessment applications; and more to come. However, many of them are reluctant to deploy the applications for real-time operations due to the lack of robustness and consistency of the tools. Thus, it becomes an urgent need to identify the key common issues of robustness and consistency of various tools for real-time security assessment. This
panel session will provide a platform for users to share experiences in this area

robustness and consistency of real-time security assessment applications in BCH
Speaker: Ziwen Yao
Affiliation: bchydro

Robustness and consistency of PJM's real-time applications
Speaker: Jianzhong Tong
Affiliation: PJM Interconnection

Robustness and consistency of ISO NE's real-time applications
Speaker: Salva Maslennikov
Affiliation: ISO New England

Robustness and consistency of PEAK-RC's real-time applications
Speaker: Hongming Zhang
Affiliation: PEAK-RC

Best Practices of Real-Time Contingency Analysis in Control Centers
Sponsoring Committee: PSO: System Operation & Control Centers Subcommittee

Session Chair: Sarma Nuthalapati, ERCOT

One of the objectives of an operator in a Control Center is to ensure that the system is being operated reliably and securely. To achieve this it is required to ensure that there are no system operating limit violations in the current operating state and also for any credible contingencies in the system. In order to achieve this, State Estimation (SE) and Real-Time Contingency Analysis (RTCA) modules become important components of any EMS system in a control center. Since there are many EMS vendors in the industry, there are different ways to implementing RTCA. IEEE Task Force on 'Real-Time Contingency Analysis' was formed to bring different vendors and users together and enable to share the experiences and knowledge about RTCA. This panel discusses some of the good practices of real-time contingencies in some of the control centers. The panelists include members of the IEEE Task Force on Real-Time Contingency Analysis

Real-Time Contingency Analysis at PJM System
Speaker: Jeremy Lin
Affiliation: PJM Interconnection

Real Time Contingency Analysis Practice at the Ontario Grid Control Centre
Speaker: Yinhua Guo
Affiliation: Hydro One
Panelist: Yinhua Guo, Jeff Penrice, Vivian Cheuk
Innovative RTCA Enhancements for Transmission Operations
Speaker: Xiaodong Liu
Affiliation: Eversource Energy
Panelist: Xiaodong Liu, Trevor W. Tessin, Richard A. Flynn

Online security assessment and automatic control action design in the Italian power system
Speaker: Diego Cirio
Affiliation: TERNA, Italian TSO
Panelist: Giorgio Giannuzzi, Diego Cirio, Stefano Massucco

Harnessing Power Electronics for System Stability though Feedback Control of FACTS, HVDC and Wind Power Plants
Sponsoring Committee: Power System Dynamic Performance

Session Chair: Annissa Heniche, Hydro-Quebec/IREQ
Session Chair: George Stefopoulos, New York Power Authority

In an effort to modernize the power grid and make it friendlier to variable-energy resources and smart demand, utilities are integrating new transmission technologies such as synchrophasors, FACTS, HVDC, and wind generators with advanced controls, resulting in a more observable and controllable grid. This combination of power-electronics-based controllers and faster wide-area monitoring systems generates new opportunities to improve the use of existing assets through feedback control, to reveal additional transfer capability across stability-limited interfaces or seamlessly integrate more inertialess generation. This panel session invites experts from around the world to report on recent applications aiming at improving system dynamic performance through supplementary control of power-electronics-based transmission and renewable generation systems. The emphasis is be on practical applications of local and wide-area continuously-acting stability controls to address damping, voltage or frequency control through supplementary modulation of FACTS, HVDC interconnections and wind generation.

Approaches to develop wide-area control resiliency to communication failures
Speaker: Vijay Vittal
Affiliation: Arizona State University

Design of Wide-Area Power System Damping Controllers Resilient to Communication Failures
Speaker: Vijay Vittal
Affiliation: Arizona State University

Stabilization of large power systems using VSC-HVDC and model predictive control
Speaker: Alexander Fuchs
Affiliation: ETH Zurich
Impact of Wind Generation Power Electronic Interface on Power System Inter-Area Oscillations
Speaker: Felipe Wilches-Bernal
Affiliation: Sandia National Laboratories

Inter-area Oscillation Damping and Primary Frequency Control of the New York State Power Grid with Multi-Functional Multi-Band Power System Stabilizers
Speaker: Dmitry Rimorov
Affiliation: McGill University

Practical Application of the Hybrid Power Flow Controller
Speaker: Claudio Canizares
Affiliation: University of Waterloo

Design and Analysis of HVDC Low Frequency Oscillation Damping Controller
Speaker: Xiaoyu Wang
Affiliation: Carleton University

Integrating TCSC to Enhance Transmission Capability and Security: Feasibility Studies for Korean Electric Power System
Speaker: Kyeon Hur
Affiliation: Yonsei University

Modeling Reactive Support from Distributed Resources in Hellenic Interconnected System
Speaker: Costas Vournas
Affiliation: NTUA

Application of Local Autonomous Protection Against Voltage Instability to IEEE Test System
Speaker: Costas Vournas
Affiliation: NTUA

Applications of Wide-area Adaptive HVDC and Generator Damping Control in Chinese Power Grids
Speaker: Yi Zhao
Affiliation: FACTs Institute

Design of Wide-Area Power System Damping Controllers Resilient to Communication Failures
Speaker: Vijay Vittal
Affiliation: Arizona State University

Approaches to develop wide-area control resiliency to communication failures
Speaker: Vijay Vittal
Affiliation: Arizona State University
This session will focus on modeling and analysis of open-phase faults (OPF) at nuclear power generating stations. This includes modeling techniques, determination/estimation of modeling parameters, discussion of analytical methods and tools, analytical techniques to determine in-plant effects (e.g. voltage and current balance, impact to plant processes or equipment), and analysis to support protective device settings.

The intent of the session is to explore the underlying electrical theory related to OPF modeling and analysis, rather than focusing on specific protective “solutions” for the OPF condition.

Open-Phase Detection Considerations for Nuclear Power Generating Station Electrical Systems
Speaker: Anthony (Tony) Sleva
Affiliation: Sleva Associates, Inc
Panelist: Tammy Womack, Dr. Abdelrahman Karrar, Preston Cooper

Influence of Zero Sequence Impedances of Station Auxiliary Transformers on Equipment Performance under Open-Phase Faults
Speaker: Elamin Mohamed
Affiliation: University of Tennessee at Chattanooga
Panelist: Dr. Abdelrahman Karrar, Mariana Kamel, Haytham Saeed

On-site Low Voltage Determination of Zero Sequence Impedances for Station Auxiliary Transformers
Speaker: Abdelrahman Karrar
Affiliation: University of Tennessee at Chattanooga
Panelist: Mariana Kamel, Haytham Saeed, Preston Cooper

Open-Phase Study in Nuclear Power Plant
Speaker: Zia Salami
Affiliation: University of North Carolina-Charlotte
Panelist: Tim Fallesen, Dr. Abdelrahman Karrar, Tammy Womack

Open-Phase Modeling and Analysis
Speaker: Salman Kahrobaee
Affiliation: ETAP
Panelist: Dr. Ahmed Saber, Dr. Abdelrahman Karrar, Preston Cooper

Analysis of Open Phase Fault Events Using ETAP Unbalanced Load Flow Module
Speaker: Preston Cooper
Affiliation: TVA
Panelist: Tim Fallesen, Tammy Womack
This panel will discuss the thinking behind the refurbishment of old HVDC and FACTS facilities and the opportunities presented by new HVDC overlays. The panel will address the economic reasons for HVDC and FACTS facilities and the operating experience of existing installations that can provide lessons learned.

TBD
Speaker: Wayne Litzenberger
Affiliation: Power Engineers
Panelist: Wayne Litzenberger

Planning challenges of HVDC Regional Interconnections
Speaker: John Chahwan
Affiliation: SNC-Lavalin
Panelist: John Chahwan

Technical challenges and Economics of Life extension of HVDC facilities – An Owners’ Engineer Perspective
Speaker: John Chahwan
Affiliation: SNC-Lavalin
Panelist: John Chahwan

TBD
Speaker: Dan Sullivan
Affiliation: Mitsubishi
Panelist: Dan Sullivan

TBD
Speaker: Paul Marken
Affiliation: GE
Panelist: Paul Marken

TBD
Speaker: Mark Reynolds
Affiliation: Power Engineers
Panelist: Mark Reynolds

TBD
Speaker: Babak Enayati
Affiliation: National Grid
Panelist: Babak Enayati

Control of PV Solar Farms as STATCOM for Transmission and Distribution Applications
Speaker: Rajiv Varma
Affiliation: Western University, Canada
Panelist: Rajiv Varma
Under the tsunamis from both coasts of the nation, the US is facing tremendous pressure to change the business model for utilities. Two initiatives — the Reforming Energy Vision (REV) in New York State and the Distributed Resource Planning (DRP) policy in California — are combining forces to generate changes across the utility industry. With Hawaii as another outpost of changes, electric utilities are earnestly seeking optimal plans for their grid and resource portfolios. This is a global trend. Distributed Energy Resources, Demand Response, Renewable Resources, Microgrids and other customer-side resources need to be integrated into the power system planning. This panel session brings together experienced practitioners to share how the industry is facing this tsunami forces while making sound financial returns on their planned investment. Then the Power System Planning & Implementation Committee
will develop sessions that highlight major outstanding power system planning issues and their possible resolutions.

Energy and Resource Forecasting
Speaker: Tao Hong
Affiliation: UNCC

Supply Resource Planning
Speaker: Joseph Yan
Affiliation: Southern California Edison

Transmission System Planning under Uncertainties & REV
Speaker: Michael Henderson
Affiliation: ISO-New England

Active Circuit Planning
Speaker: Luis (Nando) Ochoa
Affiliation: The University of Manchester

Microgrid and Customer Resources Integration
Speaker: Hiroshi Asano
Affiliation: CRIEPI

Lifecycle Asset Management
Speaker: Tony McGrail
Affiliation: Doble Engineering

System Flexibility, ROI Valuation, DRP California and REV New York
Speaker: Eamonn Lannoye
Affiliation: EPRI

Offering, pricing and managing uncertainty and variability in power system operations with significant renewable energy integration
Sponsoring Committee: Power System Planning and Implementation

Session Chair: Ning Zhang, Tsinghua University, China
Session Chair: Pierre Pinson, DTU

This panel will explore several topics that are becoming increasingly interesting:
1) How to accurately forecast the uncertainty and variability of intermittent energy and how to evaluate the forecast performance.
2) How the uncertainty and variability could be effectively revealed in the market bidding.
3) How could the uncertainty / variability and the flexibility being effectively traded and priced in the electricity market. How to allocate the cost of uncertainty and variability in a vertical integrated power system.
4) How the demand and supply of uncertainty and variability being quantified through a non-deterministic method, e.g. using reserve demand curve instead of a fixed reserve rate.
5) How to manage the uncertainty and variability in a cost-effective manner in the decision making of power system operation.
6) How to post-evaluate the decisions made for accommodating the uncertainty and variability.

Reserves in stochastic unit commitment: an Irish system case study
Speaker: Mark O'Malley
Affiliation: UCD

Towards pricing of uncertainty and variability in electricity markets
Speaker: Pierre Pinson
Affiliation: DTU

Data-Driven Real-Time Power Dispatch for Maximizing Variable Renewable Generation
Speaker: Jianhui Wang
Affiliation: Argonne National Laboratory

Probabilistic Forecasting and Optimization of Power Systems Operation
Speaker: Dimitry Gorinevsky
Affiliation: Stanford University

Remuneration of flexible capacity through operating reserve demand curves: a case study of Belgium
Speaker: Anthony Papavasiliou
Affiliation: Université catholique de Louvain

Managing wind power uncertainty through strategic reserve purchasing
Speaker: Ning Zhang
Affiliation: Tsinghua University, China

Economic Transmission Planning: Best Practices and Challenges
Sponsoring Committee: Power System Planning and Implementation

Session Chair: Rui Bo, MISO

Federal Energy Regulatory Commission (FERC) order 1000 requires public utilities and transmission planning entities to perform regional and interregional transmission planning in a cooperative manner that addresses transmission needs efficiently and cost-effectively. Under Order No. 1000, federal right of first refusal (ROFR) for a transmission facility selected in a regional transmission plan for purposes of cost allocation is removed in order to promote competition in regional transmission planning. These changes have drawn significantly greater attention to economic-based transmission planning. Nowadays, most of the ISOs/RTOs have tariffs defined for transmission projects that are justified and cost allocated based on the economic merit. Transmission
projects worth hundreds of millions of dollars have already been approved ever since.
On the other hand, the economic transmission planning is facing unprecedented challenges from many aspects such as the changing paradigm of resources due to environmental regulations, increased reliance on gas-fired resources and gas supply infrastructure, the intricacy with multi-area coordination in inter-regional planning, ever-increasing computational complexity facing greater generation uncertainties, market simulation performance measure, etc. This panel will be discussing the best practices currently employed in the industry and the challenges lying ahead.

Economic Transmission Planning at PJM
Speaker: Jeremy Lin
Affiliation: PJM Interconnection

Economic Studies at SPP
Speaker: Juliano Freitas
Affiliation: SPP

Economic Transmission Planning and the Challenges at MISO
Speaker: Rui Bo
Affiliation: MISO

Long term economic transmission planning at ERCOT
Speaker: Sandeep Borkar
Affiliation: ERCOT

Economic Planning Studies at CAISO
Speaker: Xiaobo Wang
Affiliation: California ISO

Impact of Clean Power Plant on Transmission Planning
Speaker: Jordan Bakke
Affiliation: MISO

Electricity and Gas Co-optimization in the Transmission Economic Planning
Speaker: Tao Guo
Affiliation: Energy Exemplar

Transmission Planning in an Imperfect World
Speaker: James Sustman
Affiliation: ABB

Planning and Operating with Wide Area Control of the Power Grid
Sponsoring Committee: Power System Planning and Implementation

Session Chair: Kevin Tomsovic, University of Tenesse

Identification of Control-Oriented Dynamic Models in Wide Area Power Systems
Speaker: alex Stankovic  
Affiliation: Tufts University  
Hierarchical automatic voltage controller for Southern California Edison transmission system  
Speaker: Mani Venkatasubramanian  
Affiliation: Washington State University  
Wide-area measurement based modeless inter-area oscillation control  
Speaker: Yilu Liu  
Affiliation: University of Tennessee  
Delay-Aware Co-designs for Performance Enhancement of Wide-Area Damping Controllers  
Speaker: Aranya Chakrabortty  
Affiliation: NC State University  
Wide-Area Closed-Loop Control of Dynamic Shunt Compensators at Hydro-Québec – From Proof-of-Concept to Implementation  
Speaker: Innocent Kamwa  
Affiliation: Institut de recherche d’Hydro-Québec (IREQ)  
Wide-Area Monitoring, Protection, and Control of Future Electric Power Networks  
Speaker: Vahid Madani  
Affiliation: PG&E  

Developing Systems for Flexibility - Where are the low hanging fruits?  
Sponsoring Committee: Power System Planning and Implementation  
Session Chair: Eamonn Lannoye, EPRI  

Given the rapid growth of renewables, flexibility is required in the near term. Many approaches exist which offer system flexibility depending on the characteristics of the system. This panel will examine the options and actions that have been pursued by system operators around the world to alleviate flexibility concerns in the near term. The goal of this panel is to summarize the experience of system operators when evaluating near term options that may instructive for other systems.  

Advanced Applications of Dispatchable DER in a Smart Grid Environment  
Sponsoring Committee: Power System Planning and Implementation  
Session Chair: Hiroshi Asano, CRIEPI  

Fast DR pilot in Japan  
Speaker: Hiroshi Asano  
Affiliation: CRIEPI
Dispatchable energy resources in Smart building
Speaker: Sumit Paudyal
Affiliation: Michigan Technological University

V2X application for RES integration
Speaker: Yutaka Ohta
Affiliation: Tokyo City University

Hardware-In-the-Loop (HIL) based testing of power apparatus
Sponsoring Committee: Transmission and Distribution

Session Chair: Omar Faruque, Florida State University
Session Chair: Georg Lauss, Austrian Institute of Technology

Power system is going through a paradigm change due to the integration of distributed energy resources and implementation of novel technologies. To understand the impacts of these advanced technologies and to investigate both component behavior and system level interactions in a risk-free environment, real-time simulation based hardware-in-the-loop (HIL) is being used. Prior to installation in the field, the operation of new concepts and technologies should be simulated to ensure safe operation and reduce the cost of field testing. The scope of the proposed panel session would include but not limited to the Controller Hardware-in-the-Loop (CHIL) testing and Power Hardware-in-the-Loop (PHIL) testing of power apparatus in the field of Distributed Energy Resources, micro-grids, smart grid, electric vehicles, all electric- and -plane.

Challenges of HIL methods in future standards
Speaker: Georg Lauss
Affiliation: Austrian Institute of Technology

Evaluating Smart Grid Performance with Cyber-Physical Systems HIL Test Beds: Challenges and Opportunities
Speaker: Karl Schoder
Affiliation: Florida State University
Panelist: Kar Schoder & Mischa Steurer

PHIL and CHIL simulation for testing modern distribution network control and DER
Speaker: Nikos Hatziargyriou
Affiliation: National Technical University of Athens

Hardware-in-the-loop Simulation and Test of Control and Protection Systems of MMC HVDC and UPFC Projects in China
Speaker: Wei Li
Affiliation: OPAL-RT TECHNOLOGIES

Hardware in the Loop Testing of a Photovoltaic MicroInverter
Speaker: Onyi Nzimako
Affiliation: RTDS Technologies Inc.
In the light of the possibilities offered and the challenges posed by modern smart grid solutions, the view of power systems has to become broader, including multiple (physical) domains and detailed information communication technology (ICT)-based control schemes. Different computer simulation programs were developed to satisfy the individual modeling needs of different studies in power systems and smart grid. A need was, however, quickly recognized to interface various programs to exploit their complementary strengths for model validation and to exchange data between different simulation tools. The panel session will invite experts from around the world to discuss the key interfacing techniques for the combination of different simulators in smart grid studies. The objective of the panel is to offer a common vision to researchers and engineers.

Co-Chair
Speaker:  Yi Zhang
Affiliation:  RTDS

Interfacing Power System Simulators with Geomagnetically Induced Currents (GIC) Simulation Programs
Speaker:  Luis Marti
Affiliation:  Hydro One Network

Interfacing Techniques for Electromagnetic Transient (EMT) and Transient Stability (TS) Simulation
Speaker:  Venkata Dinavahi
Affiliation:  University of Alberta

Multi-Scale Modeling and Simulation of Power Systems
Speaker:  Kai Strunz
Affiliation:  TU Berlin

Co-Simulation of Intelligent Energy Systems
Speaker:  Peter Palensky
Affiliation:  TU Delft

A Benchmark Case for Electromagnetic-Electromechanical Hybrid Simulation of HVAC Grid with Multiple HVDC Links
Speaker:  Shuqing Zhang
EMT-type wind generator models: benchmarks and demonstrations of applications
Sponsoring Committee: Transmission and Distribution

Session Chair: Jean Mahseredjian, École Polytechnique de Montréal

The objective of this panel is to present the development of accurate wind generator models for the simulation and analysis of electromagnetic transients. Such analysis includes fast and slow transients, computation of short-circuit currents, grid integration, resonance conditions and generic performance. Both real-time and off-line simulation approaches will be considered.

Safe Operation of a DFIG based Wind Park connected to a Series Compensated System
Speaker: Ulas Karaagac
Affiliation: Polytechnique Montreal
Panelist: Simon Jensen, Jean Mahseredjian

Type IV Wind Turbine Real Time Model: Development and Application
Speaker: Amgad El-Deib
Affiliation: Enercon
Panelist: Jair Cassoli, Richard Gagnon, Aramis Trevisan, Angelo Mendonca

A research on a wind-generation technology based on MMC back-to-back system and 10kV squirrel cage induction machine
Speaker: Lianghe Zhu
Affiliation: Guangdong Electric Power Research Institute
Panelist: Hongjie Weng, Deyou Wang, Mingyang Wei

Using Frequency-Scanning Method for SSCI Problem Identification and Countermeasure Design in a DFIG-based Wind Park
Speaker: Lijun Cai
Affiliation: Smart Grid Research Institute (SGRI) Europe GmbH
Panelist: Ulas Karaagac, Jean Mahseredjian

Data portability between EMT-type simulation tools
Sponsoring Committee: Transmission and Distribution

Session Chair: Jean Mahseredjian, École Polytechnique de Montréal

The objective of this panel is to present the most recent developments for creating portability between simulation tools for electromagnetic transients. Such portability aims at creating a simplified exchange of data based on the CIM format with the inclusion of specific data fields related to EMT-type models. The objective is to develop a standard that
can be adopted by all developers of EMT-type tools. Data portability includes the capability to automatically display graphics.

Data and Model portability for the simulation of Electromagnetic Transients: problem definition and benchmarks
Speaker: Jean Mahseredjian
Affiliation: École Polytechnique de Montréal

Complexities in Data Portability with EMT-type Tools
Speaker: John Muller
Affiliation: Manitoba HVDC Research Centre

CIM import tool for Electromagnetic Transients
Speaker: Cesar Martin
Affiliation: RTE-France

Challenges and Opportunities for Consistent Model Exchange and Simulation of VSC-HVdc Controls for EMT Studies
Speaker: Luigi Vanfretti
Affiliation: KTH Royal Institute of Technology

Development for integration of cross platform EMT tools
Speaker: Matt McGrail
Affiliation: DIgSILENT Americas LLC

The 2014 Revision of IEEE Std 519: Harmonic Control in Power Systems
Sponsoring Committee: Transmission and Distribution

Session Chair: Mark Halpin, Auburn University

This panel session will provide an overview of the major changes in IEEE Std 519 which deals with harmonic control in power systems. The 2014 edition of this Standard generally retains the existing approach of managing harmonics as a shared-responsibility between system owner/operators and system users, but several major changes have been made. The changes, with respect to the long-standing 1992 edition, include clarifying the intended applications of the recommend harmonic limits, specifying the ways in which harmonics are to be measured and reported, effective applications of the limits in emerging applications such as renewable generation, and new topics in the 2014 edition such as interharmonics. This session will be applicable all stakeholders in the power quality area.

Application Principles of IEEE Std 519-2014
Speaker: Mark Halpin
Affiliation: Auburn University

Measurement Techniques and Parameters for Harmonics and Interharmonics
Speaker: Rich Bingham
Affiliation: Dranetz

Statistical Harmonic Limits: 95th and 99th Percentiles
Flicker Standard- Updates, Applications and Future Direction  
Sponsoring Committee: Transmission and Distribution

Session Chair: Harish Sharma, Southern Company Services

In recent years, flicker measurement and application standards have been harmonized over the world including North America making it possible to universally apply these standards on a consistent basis. This panel session is envisioned to be an effective platform to communicate the historical evolution and recent updates in the industry standards such as publishing of IEEE Standard P1453 - Recommended Practice for the Analysis of Fluctuating Installations on Power Systems. A real-world electric arc furnace case study that will be used to illustrate the methodology of applying this standard will be presented. Then, a software implementation of a novel method of using RMS voltage waveforms to compute the standard flicker indices (Pst and Plt) will be presented. Finally, looking into the future, potential research directions on the subject will be discussed. For example, additional work that is being carried out in the field of rapid voltage changes (RVCs) will be presented that will include measurements from a car shredding facility.

History of 1453
Speaker: Ken Sedziol
Affiliation: Duke Energy

Overview of IEC 61000-4-15 and 61000-3-7
Speaker: George Lazaroiu
Affiliation: University Polytechnica of Bucharest

Addressing Flicker Issues with New Arc Furnace Installations
Speaker: Harish Sharma
Affiliation: Southern Company Services

Computation of IEC Flicker Indices using Measured Voltage Quantities
Speaker: Ivan Bilic
Affiliation: Electrotek Concepts

RVCs and Flicker
Modeling and measurement of network and equipment impedance for harmonic studies

Sponsoring Committee: Transmission and Distribution

Session Chair: Roberto Langella, Second University of Naples, Italy
Session Chair: Jan Meyer, Technische Universitaet Dresden, Germany

In order to study levels and propagation of low and high frequency components emission, knowledge about the network impedance at these frequencies is of crucial importance. The panel session is intended to discuss different aspects of modeling and measurement of harmonic impedance in the frequency range between 0.5 kHz and 50 kHz. Transmission as well as distribution networks will be covered. Moreover, the impact of the increasing capacitive behavior of modern electronic equipment will be also addressed together with the impact of the estimation of the supply impedance can have on the control of power electronic converters. The panel provides guidance how the changes in the used equipment technology can adequately be covered in studies of harmonic emission below and above 2 kHz. The panelists will present theoretical aspects and practical case studies.

Statistical and theoretical considerations on network harmonic impedance assessment
Speaker: Alfredo Testa
Affiliation: Second University of Naples
Panelist: Alfredo Testa, Roberto Langella

Aspects of harmonic impedance in LV networks in presence of electronic equipment
Speaker: Jan Meyer
Affiliation: Technische Universitaet Dresden, Germany

Characterizing Transmission System Harmonic Impedances with R-X Loci Plots
Speaker: David Mueller
Affiliation: Enernex

Power System Impedance Estimation Based on Wavelet Current/Voltage Injection
Speaker: Carlos Duque
Electrical Signatures of Power Equipment Failures
Sponsoring Committee: Transmission and Distribution

Session Chair: Wilsun Xu, University of Alberta

In recent years, the widespread use of disturbance monitoring tools have enabled industry to use disturbance data to determine the health conditions of T&D equipment. Examples are incipient faults of underground cables and overhead lines, and malfunction of switchers and tap changers. Experiences show that many equipment failures contain unique signatures in their voltage and current waveforms. There is, therefore, a great opportunity to develop specialized algorithms that make use of the signatures for equipment condition monitoring. The objective of this panel session is to share experiences on detecting and analyzing various electrical signatures related to equipment failures. The panel session will also discuss the efforts of developing an equipment signature database for research community. The ultimate goal is to create innovative condition monitoring applications based on power quality data analytics.

Electrical Signature Analytics for Equipment Condition Monitoring
Speaker: Wilsun Xu
Affiliation: University of Alberta

Signatures of Arcing and Incipient Faults from Underground Power Distribution Cables
Speaker: Tom Cooke
Affiliation: EPRI-US

Incipient Faults in Distribution Systems: Experiences, Use Cases, and Case Studies
Speaker: mirrasoul mousavi
Affiliation: ABB

Progressive Failure Signatures of Selected Line Apparatus
Speaker: Don Russell
Affiliation: Texas A&M University

Next Generation Materials for the Power System
Sponsoring Committee: Intelligent Grid Coordinating
Session Chair:  Nouredine Hadjsaid, grenoble-inp

This panel session will focus on next generation materials for the power system, including nano-materials and new alloys.

Speaker:  Doug Houseman
Affiliation:  EnerNex

Energy WG of the IEEE European Public Policy Initiative
Sponsoring Committee:  Intelligent Grid Coordinating

Session Chair:  Doug Houseman, EnerNex

per Miriam - IGCC sponsored, but not taking IGCC allotment

Presentation
Speaker:  Alex Brissette
Affiliation:  ABB, Inc

The Future of Smart Building Technologies
Sponsoring Committee:  Intelligent Grid Coordinating

Session Chair:  Alex Brissette, ABB, Inc

this one belongs to SBLCS

With proliferation of smart appliances, sensors and actuators into the residential and commercial buildings, energy efficient building control is no longer a dream. What does it mean for future smart building? What technologies can enable and support the never ending building smartness? This panel will look into the future and shine some lights.

The Future of Smart Building Technologies
Speaker:  Annabelle Pratt
Affiliation:  NREL

Smart Buildings
Speaker:  Giriji Parthasarathy
Affiliation:  Honeywell
Panelist:  girija.parthasarathy@honeywell.com

Smart Buildings
Speaker:  Cho Soolyeon
Affiliation:  NC State
Panelist:  soolyeon_cho@ncsu.edu

smart buildings
Speaker:  mirrasoul mousavi
Affiliation:  ABB
Panelist: mirrasoul.j.mousavi@us.abb.com

Grid 3.0
Sponsoring Committee: Intelligent Grid Coordinating
Session Chair: Doug Houseman, EnerNex

A look at the evolution of grid architecture. Looking at EPRI's Integrated Grid, the M-490 Grid architecture, GMS and the emerging SGIP/DOE Grid 3.0

GMS Architecture
Speaker: Jeff Gooding
Affiliation: SCE
Panelist: Jeff Gooding

What's Next
Sponsoring Committee: Intelligent Grid Coordinating
Session Chair: Doug Houseman, EnerNex

This panel will focus on emerging technologies that will have an impact on the grid, from solid state transformers, to robots and drones. The panelists will introduce topics for discussion. The goal is to find homes in the various technical committees for these technologies.

What's Next part 1
Speaker: Nouredine Hadjsaid
Affiliation: grenoble-inp

Finallizing the merger between IGCC and ETCC
Sponsoring Committee: Intelligent Grid Coordinating
Session Chair: Doug Houseman, EnerNex

This panel will present the merger activities of the two coordinating committees and the activities that need to be taken forward.

Transmission Planning for an Evolving Grid
Sponsoring Committee: Power System Planning and Implementation
Session Chair: Michael Henderson, ISO-New England

The need for transmission expansion and development of proper plans is driven by resource development, which is often determined by policy
makers and independent market participants. This panel will discuss the reasons behind transmission expansion and how optimal plans are developed. The session will provide an update on Order 1000 as a backdrop and then discuss planning techniques that measure the true value of transmission. New applications of transmission technologies and the effects of distributed resources are next discussed as a means of providing flexible expansion of the network at a time when there is greater uncertainty of surrounding resource development and retirements.

TBD
Speaker: Sean Naaykens
Affiliation: AtaLink
Panelist: Sean Naaykens

TBD
Speaker: John Buechler
Affiliation: New York ISO
Panelist: John Buechler

Offshore Wind Integration Studies for the Great Lakes
Speaker: Amirhossein Sajadi
Affiliation: Case Western Reserve University
Panelist: Amirhossein Sajadi, Kenneth Loparo

TBD
Speaker: Bernardo Fernandes
Affiliation: Siemens PTI
Panelist: Bernardo Fernandes

TBD
Speaker: Frank Zhang
Affiliation: Dominion Power
Panelist: Frank Zhang

Planning for Cross-Border Transmission and Regional Integration in Latin America
Speaker: Rafael Ferreira
Affiliation: PSR
Panelist: Rafael de Sá Ferreira, Luiz Barroso

Consideration of Active Distribution Systems in Bulk System Planning
Speaker: Daniel Brooks
Affiliation: EPRI
Panelist: Daniel Brooks

TBD
Speaker: Roy Boyer
Affiliation: Consultant
Panelist: Roy Boyer

Storage and Future Distribution Systems: Changing the Energy Landscape
Small-to-medium scale battery storage systems are more and more commercially available around the world. This technology is set to bring significant flexibility to the way end users as well as distribution system operators manage electricity flows. However, capturing the true benefits from storage requires understanding not only the technical aspects but also economic and regulatory barriers. Furthermore, the widespread use of battery storage systems in combination with local generation (e.g., photovoltaic) poses major challenges to the electricity sector as end users might become largely self-sufficient. This panel session will address some of the aspects related to these topics considering the benefits and impacts of small-to-medium scale storage from the perspectives of end users, manufacturers, and distribution system operators.

Increasing DER Hosting Capacity – Theory and Near-Term Application
Speaker: Bob Currie
Affiliation: Smarter Grid Solutions

Forecasting and Degradation: How to Get the Most Value out of Your Energy Storage Solution
Speaker: Julian de Hoog
Affiliation: IBM Research

Battery Pilots at Xcel Energy
Speaker: Chris Punt
Affiliation: Xcel Energy

Linking modeling tools across temporal and functional domains
Sponsoring Committee: Power System Planning and Implementation
Session Chair: Audun Botterud, Argonne National Laboratory
Session Chair: Aidan Tuohy, EPRI

Power system studies have traditionally been carried out using tools designed for specific timeframes (e.g. dynamic stability versus production cost) and functional requirements (e.g. transmission versus distribution). With increasing levels of Variable Generation and
Distributed Energy Resources, increased customer engagement and expected retirement of traditional generation, among other factors, there is a need to understand how these different modeling domains interact with each other. This panel will discuss a number of ongoing and recent efforts focused on either linking new and existing modeling tools, or developing integrated modeling tools that capture multiple domains. These will improve analysis of the impacts of technological and policy shifts expected in the coming years. Examples will be given of studies done, development of new tools, integration of existing tools, and research needs. We will discuss the need for and benefits of integrated tools versus improved linking of separate tools for each domain.

Integration of multiple timescales and multiple decisions in the simulation of the Electric Power System
Speaker: Erik Ela
Affiliation: EPRI

Extending Electricity Capacity Expansion Planning to consider Distributed Energy Resources
Speaker: Jesse Jenkins
Affiliation: Massachusetts Institute of Technology

Soft-linking of production cost and energy systems models to study European policy and technology changes
Speaker: Alessandro Chiodi
Affiliation: University College Cork

Integrated Models for Transmission and Distribution
Speaker: Brian Palmintier
Affiliation: NREL

Linking dynamic stability and system dispatch tools
Speaker: Gene Hinkle
Affiliation: GE Energy Management

Synchronization of Production cost modeling with Powerflow and Stability model
Speaker: Jinxiang Zhu
Affiliation: ABB
Panelist: Lan Trinh

Modeling Advanced Pumped Storage Hydropower Technologies Across Different Timescales to Analyze their Role and Value in the Modern Power Grid
Speaker: Vladimir Koritarov
Affiliation: Argonne National Laboratory

Microgrid Design Considerations
Sponsoring Committee: Transmission and Distribution
Session Chair: Amin Khodaei, University of Denver
Microgrids are becoming viable alternatives to centralized generation and bulk transmission of electricity by offering a localized power generation, regulation, and distribution. The microgrid design is subject to two major considerations, namely financial and technical. The technical considerations will focus on engineering issues necessary to design microgrids to allow for desired operations including intentional and unintentional islanding, grid-connected operation, black start, reconfiguration, load/generation dispatch, etc. This session will bring together leading authorities in microgrid deployment to discuss technical design challenges and considerations in microgrids while offering some of the identified and proven solutions. This session will be coordinated by the IEEE Microgrid Taskforce within the Distributed Resource Integration Working Group.

Microgrid Design Considerations
Speaker: Mohammad Shahidehpour
Affiliation: IIT

Microgrid Design Considerations
Speaker: Benjamin Kroposki
Affiliation: NREL

Microgrid Design Considerations
Speaker: Shay Bahramirad
Affiliation: ComEd

Protection Design for Microgrids
Sponsoring Committee: Transmission and Distribution

Session Chair: Georges Simard, S.I.M.A.R.D. SG

Traditionally, distribution protection design is based on conventional grid configuration having a single source, typically a substation, with several distribution feeders for the downstream customers. However, this configuration is going through major changes. Generation is being directly connected to the actual distribution grid at medium voltage for more than a decade. DER generation is also being installed at the residential low voltage level. These distribution generation systems bring new challenges to the protection design. Not only can this generation create reverse power flow, but the different type of generation (conventional synchronous machine, induction motor, wind turbine or PV through converters...) have an impact on the short circuit level. The transformer connections between each generation station can influence the grounding mode of the distribution system. The transition between the conventional distribution system with all the interconnected generation to the several pockets of micro grids (and vice versa) also means some kind of adaptive protection schemes and settings. This panel session will share experiences on protection design in this new context from speakers from each side of the Atlantic.

Microgrid Protections at the LV and MV in Connected or Islanded Microgrid
Advanced Distribution Automation - Progress and Challenges
Sponsoring Committee: Transmission and Distribution

Session Chair: Dino Lelic, Quanta Technology

Many distribution utilities worldwide are in the process of upgrading their systems in order to align their operations with the ‘utility of the future’ concept. This brings multi-faceted challenges to address in areas such as: feeder automation; advanced SCADA/DMS/OMS systems, telecommunication infrastructure, DER integration, synchrophasor technologies in distribution system, new system application for distribution monitoring and control, system modeling for planning and operation. In this panel session, four speakers from utilities in the US and overseas will share their experiences in various aspects of R&D, planning and implementation of utility of the future initiatives.

Introduction: Advanced Distribution Automation - Progress and Challenges
Speaker: Dino Lelic
Affiliation: Quanta Technology

Advanced Distribution Management System
Speaker: Christopher Hirsch
Affiliation: SDG&E

Duke Energy DMS & SCADA Distribution Automation - Progress and Challenges Case Study
Speaker: Steve Russell
Affiliation: Duke Energy

TBD
Speaker: Bill Chiu
Affiliation: Southern California Edison

TBD
Traditionally, distribution planners are faced with grid expansion on the basis of load growth forecast and identified grid constraints by using deterministic tools while generation is not considered. However, the modern electric distribution system is going through major changes and planning practices have to adapt. On one hand, DER (generation, storage) and new loads (EVs, Smart appliances...) are more and more connected to the distribution network while associated with an increasing use of Demand Response. On the other hand, new data is more and more available from different sources and sensors. Uncertainties of the available generation and of the new loads and the analysis of the new available data bring new challenges to distribution planners who have to deal with a new dynamic while designing the distribution system. This panel session will share experiences on distribution planning in this new context from speakers from each side of the Atlantic.
DC transmission systems with DC/DC converters  
Sponsoring Committee: Transmission and Distribution

Session Chair: Dragan Jovcic, University of Aberdeen

DC Transmission grids are intensively studied in multiple applications in Europe and China. DC/DC converters are considered as essential components in DC grids which may facilitate multiple functions, like voltage stepping, DC fault isolation and power flow. This panel will examine the opportunities that DC/DC offer to facilitate multiterminal HVDC and DC grid development. The topologies for GW-size DC/DC will be discussed, reporting industry development and research experience. The participants are leading experts from manufacturers, grid operators and Universities.

DC/DC Converters and DC hubs in DC Transmission Grids
Speaker: Dragan Jovcic
Affiliation: University of Aberdeen

CEPRI DC grid demonstrator
Speaker: Liangzhong Yao
Affiliation: CEPRI

DC grids
Speaker: Magnus Callavik
Affiliation: ABB

DC/DC Converters and their role and in future grids
Speaker: Ervin Spahic
Affiliation: Siemens

Functional requirements of a practical DC:DC transformer
Speaker: Maryam Salimi
Affiliation: Electranix

Update on the roadmap of a TSO anticipating future DC networks
Speaker: Samuel Nguefeu
Affiliation: RTE, France

ALSTOM update on DC/DC converters
Speaker: Neil Kirby
Affiliation: ALSTOM / GE

Implications of DG Interconnection Requirements
Sponsoring Committee: Transmission and Distribution
Session Chair: Jens Boemer, EPRI

This panel will address the obstacles and strategic implications of interconnection requirements associated with distributed wind and solar. If either transmission or distribution concepts are ignored, there may be opportunities missed and problems created. This panel aims to provide information and education prior to balloting the new version of IEEE P1547.

Making IEEE Std. 1547 fit for the future
Speaker: Thomas (Tom) Basso
Affiliation: National Renewable Energy Laboratory (NREL)

Structuring Interconnection Requirements around Performance Categories
Speaker: Reigh Walling
Affiliation: Walling Energy Systems Consulting, LLC

Voltage regulation, Voltage and Frequency Ride-Through: Perspective of an inverter manufacturer
Speaker: John Berdner
Affiliation: Enphase Energy

Voltage regulation, Voltage and Frequency Ride-Through: Perspective of a synchronous generator manufacturer
Speaker: Marcelo Algrain
Affiliation: Caterpillar, Inc

Preventing unintentional islanding despite robust ride-through requirements for DER: Update on latest research
Speaker: Sigifredo Gonzalez
Affiliation: SANDIA National Lab

Compatibility of Fault-Ride-Through Capability and Anti-Islanding-Detection in Inverters connected to Low Voltage Distribution Grids
Speaker: Markus Dietmannsberger
Affiliation: Helmut Schmidt University

Lessons Learned from Interconnection of DER from Both the Utility and Developer Perspectives
Speaker: Jianwei (Jay) Liu
Affiliation: PJM Interconnection LLC

International Interconnection Requirements for Renewable Energy Plants
Sponsoring Committee: Transmission and Distribution

Session Chair: Robert Nelson, Siemens

As penetration levels of renewable energy resources increase, renewable energy plants are increasingly required to perform functions traditionally required of fossil plants and to provide equal or superior performance. This panel will discuss functions and performance requirements presently required of renewable resources around the world.
Panelists will include representatives from Europe and Latin America, as well as vendors of renewable energy equipment. Topics will include voltage and frequency response, response speed, pseudo-inertial response, and requirements for fault current.

Speaker: István Erlich  
Affiliation: Duisburg-Essen University

Wind Requirements and Testing for Steady-State Voltage and Frequency Control  
Speaker: Steven Saylors  
Affiliation: Vestas  
Panelist: Steven Saylors

Renewable Energy Resource Requirements and Testing for Speed of Response for Voltage and Active Power Control  
Speaker: Jason MacDowell  
Affiliation: GE  
Panelist: Jason MacDowell

Wind Resource Requirements for Transient Abnormal Frequency (Pseudo-Inertial) Response  
Speaker: Markus Fischer  
Affiliation: Enercon  
Panelist: Markus Fischer

Renewable Energy Resource Requirements for Fault Ride Through and Fault Current Response  
Speaker: Claudia Rahmann  
Affiliation: University of Chile  
Panelist: Claudia Rahmann

Requirements for Modeling and Validation of Power System Models for Wind Generation  
Speaker: Frank Martin  
Affiliation: Siemens  
Panelist: Frank Martin

Advanced Interconnection Capabilities of Renewable Energy Resources  
Speaker: Charles Smith  
Affiliation: UVIG  
Panelist: Charles Smith

Challenges in Design of Wind and Solar Power Plant Grounding System for Personal Safety  
Sponsoring Committee: Transmission and Distribution

Session Chair: Gopal Padmanabhan, Renewable Energy Systems Americas Inc.
This Panel Session discusses the many challenges imposed to the design Engineer to provide an effective Wind or solar power plant grounding system with the focus on personnel safety.

Comparison of Copper and Copper Clad Steel Conductors for WPP Grounding Application
Speaker: Abdou Sana
Affiliation: RES Americas

Challenges of Solar Power Plant Grounding
Speaker: Rob Schaerer
Affiliation: POWER Engineers, Inc

Applicability of Electrical Code to WPP & Solar Power Plant Grounding
Speaker: Tracker Tracker Goree
Affiliation: RES Americas

Wind Power Plant Grounding System Design Challenges on High Resistivity Ground
Speaker: Andrew Cadmore
Affiliation: RES Group

Evolving Requirements and Capabilities of Grid Connected Inverters
Sponsoring Committee: Transmission and Distribution
Session Chair: Doug Price, DNV GL

PV plant interconnection technical requirements directly impact inverter requirements and are in turn impacted by developments in inverter capabilities. PV interconnection requirements are merging toward harmonization with wind resources requirements, and inverter capabilities must address differences in transmission and distribution connection requirements. The panel will discuss recent and imminent interconnection requirements changes, including IEEE 1547 and NERC, and the impacts to inverter requirements and capabilities including voltage range and regulation capability, dynamic reactive power compensation, and ratings standardization to include reactive capability. The panel will then discuss inverter developments impacts on electric balance of plant design including transformer selection, AC cable selection, inverter vs. static compensation optimization, grounding including negative grounding/bias, protection and control. Finally, the panel will discuss SCADA systems role in compliance including primary frequency response.

Evolving Requirements and Capabilities of Grid Connected Inverters
Speaker: Elie Nasr
Affiliation: Bonfiglioli USA & Canada

Evolving Requirements and Capabilities of Grid Connected Inverters
Speaker: Ben Banerjee
Affiliation: Schneider Electric

Evolving Requirements and Capabilities of Grid Connected Inverters
Significant amount of research is ongoing around the world on DC grids. This trend will continue into the future, and it is expected that large offshore wind farms will also come into the picture to supply the increasing load. However, before a DC grid could be developed, there are several major technical challenges that must be overcome. Some of these challenges include:

- Developing concepts for DC voltage and power flow control within the DC grid
- Need for dc voltage transformation and fast protection for isolation within the DC grid
- In addition to these challenges, other issues such as planning, design, and operational considerations including reliability, and security, as well as the need for standardization and grid codes for DC grids shall be considered.

This panel session on DC grids addresses some issues related to technology needs, design, and operational considerations, as well as presents some real world case studies.

Converter Selection for Products of the HVDC Network
Speaker: Dale Osborn
Affiliation: MISO

DC and AC Grid Continental Wide Performance Analysis
Speaker: Dennis Woodford
Affiliation: Electranix

Methods of Detection and Clearing Faults in DC grids
Speaker: Mojtaba Mohaddes
Affiliation: TransGrid Solutions

Challenges and technology development for DC Grids
Speaker: Ervin Spahic
Affiliation: Siemens

DC Grid Technologies
Speaker: Neil Kirby
Affiliation: ALSTOM / GE

From HVDC links in AC Grids to multiterminal HVDC - building blocks and methods
Speaker: Magnus Callavik
Affiliation: ABB
A roadmap for the development of a European Supergrid
Speaker: Norman MacLeod
Affiliation: Parsons Brinkerhoff (PB)

Wide-area Control of the North American System with and HVDC Overlay
Speaker: Kevin Tomsovic
Affiliation: University of Tennessee

Grid Development in the U.S. Leveraging Proven HVDC Capabilities
Speaker: Jay Caspary
Affiliation: Southwest Power Pool (SPP)

Friends of the Supergrid
Speaker: Pierre Bernard
Affiliation: Friends of the Supergrid

Evaluation of HVDC Back to Back Interconnections in North America
Speaker: James McCalley
Affiliation: Iowa State University

Asian and Australasian Contribution for the Development of Smart Grid Technology
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Michael Negnevitsky, University of Tasmania
Session Chair: Subrata Mukhopadhyay, GTBIT, GGSIP University

It is well-known that Smart Grid is a Modernized Grid that uses extensively Information and Communication Technology (ICT), be it Geographical Information System (GIS) or secured information right from generation from various sources including Renewable Energy Sources (RES) to utilization of electricity through transmission and distribution so as to improve efficiency, reliability, economics and sustainability including cost-effective storage in an automated manner for the system as a whole. It may be applicable to very large integrated grid as well as small isolated one due to some restriction. This panel session, therefore, is marked by presentations highlighting Asian and Australasian contribution for the Development of Smart Grid Technology as such and sharing the experience gathered for further applications elsewhere within the region or outside.

How smart wide area controls change transmission infrastructure for Australia
Speaker: Gerard Ledwich
Affiliation: Queensland University of Technology
Panelist: Gerard Ledwich

Role of Energy Storage and Demand Response in Smart Grid
Speaker: Rahul Walawalkar
Affiliation: Customized Energy Solutions India Pvt. Ltd.
Panelist: Rahul Walawalkar
Wind Solar Hybrid System: Smart and Innovative Approach to Maximize Renewable Generation and Enhance Efficiency
Speaker: Vinod Agrawal
Affiliation: ReGen Powertech Pvt. Ltd.
Panelist: Vinod Kumar Agrawal

Northeast Asia Power System Interconnection Operation Plans Utilizing Global Information System in South Korea
Speaker: Sang-Seung Lee
Affiliation: KESRI
Panelist: Sang-Seung Lee, Byung Ha Lee

Experience on SCADA Cyber Security in Smart Grid
Speaker: Yi Yang
Affiliation: Jiangsu Electric Power Company Research Institute
Panelist: Yi Yang, Kieran McLaughlin, Sakir Sezer

Adaptive Neuro-Fuzzy Synchronization in Isolated Power Systems with High Wind Penetration
Speaker: Michael Negnevitsky
Affiliation: University of Tasmania
Panelist: Michael Negnevitsky

No Load Diesel Application to Maximise Renewable Energy Penetration in Isolated Power Systems
Speaker: Michael Negnevitsky
Affiliation: University of Tasmania
Panelist: Michael Negnevitsky

Opportunities and challenges for international integration and multi-sector coordination of energy systems
Sponsoring Committee: Energy Development and Power Generation
Session Chair: Rodrigo Moreno, Universidad de Chile & Imperial College London
Session Chair: Bernardo Bezerra, PSR
There is an important opportunity to connect higher levels of renewable generation and improve the economic and reliability performance of the power system by integrating energy systems across countries (e.g. through cross-border interconnections) and sectors (e.g. electricity and gas). Such integration, however, imposes significant challenges at several levels (regulatory, commercial and technical) that are currently unresolved. In this context, panellists from both academia and industry will share their experiences and discuss the latest developments that can facilitate regional integration and multi-sector coordination (e.g. electricity and gas) in both the developing and developed world.

Meeting the challenges of integrating renewable resources in New England by using cross-border interconnection
Speaker: Michael Henderson
Affiliation: ISO-New England
Panelist: Michael Henderson, Peter Wong

The benefits of integrating European electricity markets
Speaker: Goran Strbac
Affiliation: Imperial College London
Panelist: Goran Strbac, David Newbery, Ivan Viehoff

Integration in the Andes community: Electricity, renewables and gas
Speaker: Hugh Rudnick
Affiliation: Pontificia Universidad Catolica de Chile
Panelist: Hugh Rudnick, Rodrigo Palma, Enzo Sauma

Integrated technical and economical analysis of electricity and gas integration in Latin America
Speaker: Luiz Barroso
Affiliation: PSR
Panelist: Luiz Barroso, Bernardo Bezerra, Rodrigo Moreno

Identification of best practices for new technology adoption and regional integration of electric power systems in Latin America
Speaker: David Elizondo
Affiliation: Quanta Technology
Panelist: David Elizondo, Ramon Leon

Towards Development of Smart Cities and Villages - Asian and Australasian Experience
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Subrata Mukhopadhyay, GTBIT, GGSIP University
Session Chair: Michael Negnevitsky, University of Tasmania

Smart Grid concept suggests a wide use of Renewable Energy Sources (RES) along with the other conventional ones with a view to gradually replace the former for sustainability. On the other hand by deploying measures like, Demand Side management (DSM), taking advantage of Demand Response (DR), Distributed Generation (DG), usage of Smart Appliances, etc.,
effort is being made at load-end towards saving in energy with reliability in availability of electricity at a most cost-effective manner and with high degree of efficiency for the system as a whole. Accordingly this panel session is aimed at presenting applications of ways and means for developing Smart Cities and encompassing alternative approach for Smart Rural Development using such basic concept towards distribution and utilization of electric energy.

Smart Rural Development - encompassing an alternative approach
Speaker: Subrata Mukhopadhyay
Affiliation: GTBIT, GGSIP University
Panelist: Subrata Mukhopadhyay, Ashok Rajput

Smart Grid for Indian Scenario - in view of the proposed 98/100 smart cities
Speaker: Subrata Mukhopadhyay
Affiliation: GTBIT, GGSIP University
Panelist: Subrata Mukhopadhyay, Ashok Rajput

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Speaker: Subrata Mukhopadhyay
Affiliation: GTBIT, GGSIP University
Panelist: Subrata Mukhopadhyay, Ashok Rajput

Smart Grid Technology Deployment in a 3.3 MW Utility Scale PV Plant in Australia
Speaker: Tapan Saha
Affiliation: The University of Queensland
Panelist: Tapan Kumar Saha, M J E Alam, R Yan

Smart Grid Implementation in India – Experiences from the pilot project implementation
Speaker: Amit Jain
Affiliation: Central Power Research Institute
Panelist: Amit Jain

Implementation of Smart Grid project at Bengaluru, India by Bangalore Electricity Supply Company (BESCOM)
Speaker: S. A. Khaparde
Affiliation: Indian Institute of Technology Bombay
Panelist: S A Khaparde, Pankaj Kumar Pande, R S Ravish Kumar

A case study of a Smart City in India
Speaker: Ajoy Das
Affiliation: AECOM
Panelist: Ajoy Das, Richard Bucci, Reynaldo Silvestre
International development for global energy internet and interconnection worldwide

Sponsoring Committee: Energy Development and Power Generation

Session Chair: Kit Po Wong, University of Western Australia, Perth Australia

Session Chair: Loi Lei Lai, State Grid Energy Research Institute, Beijing China

This panel reports challenges and opportunities in the global energy Internet and interconnection. The development of the Global Energy Internet and interconnection (GEI) is based on Ultra High Voltage AC/DC and smart grid technology, which provides a secure means in promoting clean, cost-effective and sustainable energy. Energy Internet (EI) integrates all forms of energy based on information flow via the Internet. Case study based on practical systems will be given.

Optimal Dispatch for MTDC connected Wind Farms
Speaker: Zhao Xu
Affiliation: The Hong Kong Polytechnic University, Hong Kong
Panelist: Zhao Xu

Multi-objective joint-planning of EV charging and distribution systems considering stochastic charging loads
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Shu Wang, Zhao Yang Dong

Robust dispatch of multiple energy resources and flexible loads in energy internet
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Cuo Zhang, Yan Xu, ZhaoYang Dong, Jin Ma

Discussion on risk assessment of global energy internet
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Hui Hou, Wuhan University of Science and Technology, China, Junhua Zhao, Zhaoyang Dong, Guorong Zhu, Wei Chen

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Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Shu Wang, Zhao Yang Dong

Simulation and planning of short circuit power in low inertia systems
Speaker: Guangya Yang
Affiliation: Denmark University of Technology
Panelist: Guangya Yang

Robust dispatch of multiple energy resources and flexible loads in energy internet
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Cuo Zhang, Yan Xu, Zhao Yang Dong, Jin Ma

Discussion on risk assessment of global energy internet
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Hui Hou, Wuhan University of Science and Technology, China, Junhua Zhao, Zhao Yang Dong, Guorong Zhu, Wei Chen

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Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Shu Wang, Zhao Yang Dong

Applying the VPP concept for Regional Optimization of Level 3 Charging Station Design
Speaker: Wei-Jen Lee
Affiliation: University of Texas at Arlington
Panelist: Piampoom Sarikprueck, Wei-Jen Lee, Asama Kulvanitchaiyanunt, Victoria Chen, Jay Rosenberger

The design of cryptographic protocols and the choice of cryptographic algorithms for energy internet
Speaker: Loi Lei Lai
Affiliation: State Grid Energy Research Institute, Beijing China
Panelist: Loi Lei Lai, Joe Chan

Distributed intelligent techniques and approaches to energy internet design and implementation
Speaker: Chun Sing Lai
Affiliation: University of Oxford
Panelist: Chun Sing Lai, Malcolm McCulloch

Global Power & Energy Internet Dialogue Industry 4.0
Speaker: Xiao-Ping Zhang
Affiliation: University of Birmingham
Panelist: Xiao-Ping Zhang
International development in big data analytics to smart grid deployment
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Loi Lei Lai, State Grid Energy Research Institute, Beijing Chin

Session Chair: Kit Po Wong, University of Western Australia, Perth Australia

In this panel various techniques and good practices, standards on big data analytics will be looked at. Examples will be used to illustrate the challenges and opportunities ahead. Case study will be used to demonstrate the capability of developed techniques applied to smart grid deployment.

The fusion of thoughts on Macro Energy Systems and Big Data
Speaker: Yusheng Xue
Affiliation: State Grid Electric Power Research Institute
Panelist: Xue Yusheng

Optimal Granule-Based PIs Construction for Solar Irradiance Forecast
Speaker: Zhao Xu
Affiliation: The Hong Kong Polytechnic University, Hong Kong
Panelist: Zhao Xu

A novel framework for analyzing the big data of residential appliances in the Smart Grid Environment
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: J Yang, JH Zhao, ZY Dong, FS Wen

A new filtering algorithm for non-intrusive load modelling
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: W. Kong, Y Xu, ZY Dong, DJ Hill

Mining synchronous data for power system stability monitoring and control
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Yan Xu, ZhaoYang Dong, Kit Po Wong

Data based wind power operations and planning
Speaker: Joe Dong
Affiliation: University of Sydney
Panelist: Y. Zhang, Joe Dong

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Panelist:  W. Kong, Y Xu, ZY Dong, DJ Hill  

Mining synchronous data for power system stability monitoring and control  
Speaker:  Joe Dong  
Affiliation:  University of Sydney  
Panelist:  Yan Xu, ZhaoYang Dong, Kit Po Wong  

Data based wind power operations and planning  
Speaker:  Joe Dong  
Affiliation:  University of Sydney  
Panelist:  Y. Zhang, Joe Dong  

Data based wind power operations and planning  
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Mining synchronous data for power system stability monitoring and control  
Speaker:  Joe Dong  
Affiliation:  University of Sydney  
Panelist:  Yan Xu, ZhaoYang Dong, Kit Po Wong  

A new filtering algorithm for non-intrusive load modelling  
Speaker:  Joe Dong  
Affiliation:  University of Sydney  
Panelist:  W. Kong, Y Xu, ZY Dong, DJ Hill  

A novel framework for analyzing the big data of residential appliances in the Smart Grid Environment  
Speaker:  Joe Dong  
Affiliation:  University of Sydney
Detail Analysis of Smart Meter Data to Improve the Accuracy of Load Forecasting
Speaker: Wei-Jen Lee
Affiliation: University of Texas at Arlington
Panelist: Xin Wang, Franklin L. Quilumba, Wei-Jen Lee, Heng Huang, David Y. Wang

Cloud based smarter demand side awareness and management
Speaker: Xiao-Ping Zhang
Affiliation: University of Birmingham
Panelist: Xiao-Ping Zhang

Some mathematical and operational challenges with high-dimensional analytics with renewable energy generation and electric power demand
Speaker: Pierre Pinson
Affiliation: Denmark Technological University
Panelist: Pierre Pinson

Optimal Integration of Variable Renewable Generation into Power Systems - Grid Expansion vs. other Flexibility Options
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Antje Orths, Energinet.dk
Session Chair: Krzysztof Rudion, University of Stuttgart, Institute of Power Transmission and High Voltage Technology

The integration of variable renewable energy resources (RES) - or “green generation” impacts the electricity system in various ways, as system loading, voltage profiles, stability levels, etc. Thus, depending on the penetration level of RES there are increasing requirements regarding grid reinforcement and grid extension activities. However, the extension process can be optimized through the application of various flexibility options. This session will give an overview of the approaches used in the European countries regarding the grid planning and grid operation tasks within the system with high penetration of RES under consideration of the new flexibilities. The results of some big European and national projects will be presented.

Optimal Integration of Variable Renewable Generation into Power Systems - Grid Expansion vs. other Flexibility Options
Speaker: Krzysztof Rudion
Affiliation: University of Stuttgart, Institute of Power Transmission and High Voltage Technology
Panelist: Antje Orths, Krzysztof Rudion

Next generation transmission planning
Speaker: Hakan Ergun
Affiliation: KU Leuven
Panelist: Hakan Ergun, Dirk Van Hertem
Long term energy storage and transmission expansion planning - A techno-economic analysis
Speaker: Shahab Torbaghan
Affiliation: TU Delft
Panelist: S. S. Torbaghan, M. Gibescu, M. van der Meijden

Dynamic Curtailment Method for Renewable Energy Sources in Distribution Grid Planning
Speaker: Pascal Wiest
Affiliation: University of Stuttgart
Panelist: Pascal Wiest, Krzysztof Rudion, Alexander Probst

A comparison of flexibility options in Northern Europe
Speaker: Juha Kiviluoma
Affiliation: VTT Technical Research Centre of Finland
Panelist: Kiviluoma Juha, Helistö Niina, Rinne Erkka, Holttinen Hannele

Transmission planning, flexibility measures and renewables integration for the Irish power system
Speaker: Damian Flynn
Affiliation: University College Dublin
Panelist: D. Flynn, M. Power

Frequency control in low-inertia systems
Speaker: Janusz Bialek
Affiliation: Skoltech
Panelist: Janusz Bialek, Changhong Zhao, Enrique Mallada, Steven Low

Observability and Controllability in distribution systems with high infeed from renewables
Speaker: Andre Naumann
Affiliation: Fraunhofer IPP
Panelist: Andre Naumann, Przemyslaw Trojan, Przemyslaw Komarnicki, Marc Richter

The role of flexible grid-impacting technologies in the evolution of the pan-European system: the GridTech project analyses
Speaker: Angelo L'Abbate
Affiliation: RSE (Ricerca sul Sistema Energetico) S.p.A.
Panelist: Angelo L’Abbate, Roberto Calisti, Francesco Careri, Stefano Rossi

Energy efficiency and smart cities
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Johanna Myrzik, TU Dortmund Institut für Energiesysteme, Energieeffizienz und Energiewirtschaft

Session Chair: Mart van der Meijden, TenneT TSO B.V.
The increasing population in cities is an additional challenge and it requires an enormous effort for reducing the greenhouse gases. Cities have a high and still increasing demand on electricity, gas, heating and cooling. An optimal use of multi energy systems in the urban environment using smart control and communication technologies and the implementation of e-mobility is the key towards highly efficient and carbon-reduced cities. Therefore, in the framework of Smart Grids, Smart Cities take a particular role. The panel will provide the newest research results about running pilot and demonstration projects in Europe concerning energy efficiency and smart cities. The main issues of multi-energy systems, DSM, cogeneration and urban smart grid technologies will be pointed out under different perspectives. In general, the impact of mass implementation of distributed generators and energy efficiency measures on our daily live in cities now and in the future will be discussed.

Multiple Energy Systems
Speaker: Pierluigi Mancarella
Affiliation: Manchester University

Energy efficiency in districts-Non technical drivers
Speaker: Paul Baginski
Affiliation: University of Duisburg-Essen

Ancillary services provided by smart communities: Practical experience by power matcher
Speaker: Koen Kok
Affiliation: TNO, The Netherlands

Multi-agent systems for demand flexibility management in the built environment
Speaker: Luis Hurtado-Munoz
Affiliation: Technische Universiteit Eindhoven

Smart city as source for flexibility
Speaker: Johanna Myrzik
Affiliation: TU Dortmund Institut für Energiesysteme, Energieeffizienz und Energiewirtschaft

Contribution of smart cities and prosumers to system flexibility and network flexibility
Speaker: Mart van der Meijden
Affiliation: TU Delft

HVDC Grids - The European Perspective
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Antje Orths, Energinet.dk
Session Chair: Dirk Westermann, Technische Universität Ilmenau

The energy revolution in Europe places new requirements on the transmission grid. If it comes to large scale wind power integration in
the north of Europe, as well as bulk solar power production in south, long distance bulk power transmission becomes integral part of an entirely new power system where new controllable devices will operate to make transmission smarter. In the last consequence a new network layer based on HVDC technology will be built which is referred to as an overlay grid in Europe. This session is about activities carried out in Europe and focusing on the meshed HVDC grids.

Expected Attendance: 150

Is your panel session similar to the subject matter of one of the super sessions?: False
If yes, which one:

Recent developments in design and operation methods of meshed HVDC grids
Speaker: Dirk van Hertem
Affiliation: KU Leuven Belgium

Cutting edge of technology for HVDC paths
Speaker: Hermann Koch
Affiliation: Siemens

Current Status of the first embedded HVDC scheme in Europe - Part 1
Speaker: Gabriel Bardux
Affiliation: RTE France

Current Status of the first embedded HVDC scheme in Europe - Part 2
Speaker: Luis Coronado
Affiliation: REE Spain

Mastercontroller for Interconnected Operation of HVDC Links
Speaker: Anne-Katrin Marten
Affiliation: TU Ilmenau

Definition of corrective converter set-points on the basis of dynamic fault simulations and OPF-calculations
Speaker: Florian Sass
Affiliation: Technische Universität Ilmenau

Automated Operation of quasi parallel HVDC Links within an interconnected AC Network
Speaker: Katharina Frey
Affiliation: Institute of Power Transmission and High Voltage Technology

HVDC grid operation from a Transmission System Security Center perspective
Speaker: Alexander Küster
Affiliation: TSCNET

HVDC Grids - Advances in Network and Station Control Systems
Speaker: Martin Wolter
Affiliation: Otto von Guericke University
Transmission system security for time now and near future based on PMU measurements and model-based simulation
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Rainer Krebs, Siemens AG, Energy Management
Session Chair: Johann Jaeger, Friedrich-Alexander University Erlangen-Nuremberg

The session is addressing European developments and activities for an intelligent improvement of the flexibility and utilization of transmission systems and security increase. In Europe the amount of fluctuating renewable infeeds to transmission networks as bulk generation of large windfarms or as distributed generation in MV networks requires new strategies in system operation. The panel comprises contributions related to long term planning of the European Transmission System as well as high speed cutting-edge solutions for the assessment of the dynamic and protection security. First analysis results of AC protection behavior during DC operation on planned hybrid AC/DC transmission corridors in Germany, with AC and DC on one tower, will be presented. The increasing amount of fluctuating infeeds requires an increased observability by PMUs as well as fast acting wide-area control schemes, based on PMU streaming data, which will perfect the panel session’s presentations.

Ensuring future European transmission system security – Results of eHighway2050 project
Speaker: Rainer Krebs
Affiliation: Siemens AG, Energy Management
Panelist: Krebs, Rainer, Strunz, Kai

Dynamic Security Assessment with integrated SPS simulation as Network Application in Control Center Software – First Experiences
Speaker: Chris Heyde
Affiliation: Siemens AG, Energy Management
Panelist: Heyde, Chris, Kerin, Uros, Krebs, Rainer

Automated protection security assessment for large distribution networks
Speaker: Thomas Bopp
Affiliation: Siemens AG, Energy Management
Panelist: Bopp, Thomas, Zhu, Yaming, Blug, Christian

Dynamic Protection Security Assessment – Idea, Approach and Examples
Speaker: Christian Romeis
Affiliation: Friedrich-Alexander University
Panelist: Romeis, Christian, Jaeger, Johann, n.n. RTE France

AC Line Protection Behavior on Hybrid AC/DC Line Corridors
Speaker: Jakob Schindler
Affiliation: Friedrich-Alexander-University of Erlangen-Nuremberg
Panelist: Schindler, Jakob, Jaeger, Johann, Krebs, Rainer, n.n., Amprion
A contribution to Synchrophasor Testing and HIL Testing of PMUs for System monitoring
Speaker: Marjan Popov
Affiliation: TU Delft University of Technology
Panelist: Popov, M., Tyuryukanov, I., Rietveld, G., Meijden, van der M.

Power System Monitoring and Challenges for Future Control Schemes
Speaker: Przemyslaw Komarnicki
Affiliation: Fraunhofer Institute for Factory Operation and Automation
Panelist: Komarnicki, P., Marten, A.

Speaker: Johann Jaeger
Affiliation: Friedrich-Alexander University Erlangen-Nuremberg

ICE-BREAKING PROJECTS IN ELECTRIC POWER SYSTEM ENGINEERING
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Uros Kerin, Siemens
Session Chair: Anne-Katrin Marten, TU Ilmenau

The world’s growing demand for sustainable energy is the driving force behind many research and development and industrial projects. The world's tallest building, unmanned offshore oil platforms, floating LNG processing vessels, HVDC multi-terminal power transmission, long-distance AC transmission, FACTS design and installation, integration of dispersed generation, implementation of energy efficiency, and, last but not least, power system control have one thing in common: superior electrical engineering. This session presents an overview of the ice-breaking research and development and industrial projects from all over the world, many of them being unique or even world records, and their impact on the trends driving the electric power system engineering development. The session aims at bringing together lead engineers from various disciplines to provide information on cutting-edge engineering techniques and solutions.

Installation of two synchronous condensers at San Diego Gas and Electric’s Talega Substation
Speaker: Uros Kerin
Affiliation: Siemens

Eastern Alberta HVDC Transmission Line Project of ATCO Electric
Speaker: Uros Kerin
Affiliation: Siemens

ULTRANET – An HVDC Interconnection Between North and South of Germany
Speaker: Uros Kerin
Affiliation: Siemens

Installation of two synchronous condensers at San Diego Gas and Electric’s Talega Substation
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Affiliation: Siemens

Installation of two synchronous condensers at San Diego Gas and Electric’s Talega Substation
Speaker: Uros Kerin
Affiliation: Siemens

Synthetic Inertia Issue in Future Grids and Frequency Stabilizer as a Solution
Speaker: Ervin Spahic
Affiliation: Siemens

Master Controller for Interconnection Operation for Project Kriegers Flak Combined Grid Solution
Speaker: Rasmus Olsen
Affiliation: Energinet.dk

Most powerful and highest installed STATCOM energized up to now in the world
Speaker: Mauricio Canal
Affiliation: Interconexión Eléctrica S.A. (ISA)

First SVC with Reactive Power Control for several Reactive Power Compensation Units
Speaker: Walter Causarano
Affiliation: Administracion Nacional de Electricidad (ANDE)

Smart Integrated Renewable Energy Systems (SIRES)
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Rama Ramakumar, Oklahoma State University

The idea of utilizing locally available renewable energy resources to improve the living environment in remote rural areas of the world has been discussed for well over four decades. Several archival publications can be found in IEEE Transactions, Solar Energy Journal, and the like.
The most viable idea arising out of long-time involvement on this topic is the concept of Integrated Renewable Energy Systems (IRES) developed at Oklahoma State University. The smartness of IRES is embedded in prioritizing the needs, a-priori matching of resources and needs and emphasizing “energization” rather than “electrification.” Recently, the IEEE-PES community has revived global interest in this area under its Smart Village program. This Panel is organized to discuss the past, present and future of efforts to empower remote communities around the world.

Smart Integrated Renewable Energy Systems (SIRES)
Speaker: Rama Ramakumar
Affiliation: Oklahoma State University
Panelist: Anil Pahwa, Kansas State University, Kaveh Ashenayi, The University of Tulsa, Ward Jewell, Wichita State University, Ray Larsen, Stanford University, Henry Louie

US view of Rural Electrification
Speaker: Anil Pahwa
Affiliation: Kansas State University
Panelist: Ifehtty

A view of rural energy solutions
Speaker: Ward Jewell
Affiliation: Wichita State University

Energy Solutions for Bali
Speaker: Kaveh Ashenayi
Affiliation: The University of Tulsa

The IEEE Smart Village Initiative
Speaker: Ray Larsen
Affiliation: Stanford University

Current R&D in Photovoltaics: technology and grid integration
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Badrul Chowdhury, University of North Carolina-Charlotte

By the end of 2008 – the largest solar installation in the US was the 14MW at Nellis Air Force Base, NV. The largest installation in the world was just a 60MW plant located in Olmedilla, Spain. There is currently over 8.4GW of major solar projects operating in the USA. Eight of the ten largest solar panels are installed in the US including a 579 MW PV facility that went online in 2015. In 2014, there were over 40GW of new PV installations worldwide taking the total global solar power generating capacity to 180GW, representing a 28% increase in one year. Almost every major utility is facing with growing penetration of solar generation, and this is beginning to create operational and planning challenges. This panel of experts from industry, national labs, and academia will take a
look at the challenges, opportunities and potential solutions in grid-tied solar PV technology.

Planning for distributed generation  
Speaker: Tom Key  
Affiliation: EPRI

Testing and certification for PV systems  
Speaker: Benjamin Kroposki  
Affiliation: NREL

Addressing the uncertainty in variable generation through forecasting  
Speaker: Hugo Carreira Pedro  
Affiliation: UCSD

A View from the Low Side of the Point of Common Coupling (PCC)  
Speaker: Jim Bing  
Affiliation: Neo Virtus Engineering, Inc.

Integration of grid operations and related standards  
Speaker: Abraham Ellis  
Affiliation: Sandia National Labs

Utility business models, rate design and regulatory issues pertaining to high penetration of PV  
Speaker: Julio Aguero  
Affiliation: Quanta

Speaker: Khai Le  
Affiliation: Power Costs, Inc.

Flexible Energy Systems  
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Mark O'Malley, UCD

Session Chair: Benjamin Kroposki, NREL

The need for flexibility in electricity grids, in particular with high variable renewable energy penetration levels, has recently been recognized. Quantification of flexibility needs indicates that the sources within the electricity grid may be limited in the future. However a broader energy system perspective where flexibility from e.g. thermal, water and fuel systems is considered in an integrated approach can greatly improve the ability of the electricity grid to integrate large amounts of variable renewable energy sources in a cost effective manner. In order to achieve this will require the correct market designs, regulatory approaches and policy underpinning along with intelligent controls, and most importantly the willing participation of
the energy service consumers (individuals and/or industry). This panel will bring together experts in all aspects of energy systems to assess the likely benefits of a future flexible energy system from a technical, economic, and societal perspective.

Enabling flexibility in the energy system through markets, regulation and policies.
Speaker: William Dhaeseleer
Affiliation: KuLeuven

Flexibility in thermal energy systems
Speaker: Henrik Madsen
Affiliation: DTU

Flexibility in the water system
Speaker: Bryan Hennegan
Affiliation: NREL

Measuring and Enabling Resiliency using Microgrid
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Anurag Srivastava, Washington State University

Building grid resiliency has gained greater urgency in recent years. Keeping the power on to critical facilities such as hospitals and fire department during extreme weather events and other electric grid disruptions is essential. Microgrids improve the reliability of the critical loads in natural disasters and grid disturbances. With additional planning and design, microgrid can also help to restore critical loads outside microgrid and hence increase the system resiliency. Additionally, US Department of Energy funded number of projects to enable system resiliency using microgrid resources ending in 2015 or 2016. This panel will focus on defining resiliency and experience with several microgrid projects for enhancing the system resiliency and providing case for additional values to the microgrids development.

Microgrids for enhancing the community resilience
Speaker: Mohammad Shahidehpour
Affiliation: IIT

Microgrid Plant Control Design and Development
Speaker: Herman Wiegman
Affiliation: GE Global Research

Using Resilience Analysis to Determine Power Systems Optimal Planning and Operation
Speaker: Ross Guttromson
Affiliation: Sandia National Lab

Enhancing and Enabling the Resiliency of The Navy Yard ‘s Smart Grid Network
Speaker: Mani Venkata
Affiliation:  Alstom  
Panelist:  Jayant Kumar  

Measuring Microgrid Resiliency at the National Laboratories: Overview of Experimental Results at NREL  
Speaker:  James Kale  
Affiliation:  National Renewable Energy Laboratory  

Resilience Metric computation framework and its impact on microgrid management systems  
Speaker:  SAYONSOM CHANDA  
Affiliation:  Idaho National Laboratory  
Panelist:  Manish Mohanpurkar, Anurag Srivastava, Rob Hovsapian  

Reliability Modeling for Cyber-Physical Power Systems  
Sponsoring Committee:  (PSACE) Reliability and Risk Analysis  
Session Chair:  Ming Ni, NARI Technology Inc.  

Substation level Cyber-Physical System reliability modelling  
Speaker:  Chanan Singh  
Affiliation:  Texas A& M University  

Hybrid system modeling of Cyber-Physical System for distribution grid  
Speaker:  Dong Liu  
Affiliation:  Shanghai Jiao Tong University  

Distribution level Cyber-Physical System reliability modelling  
Speaker:  Visvakumar Aravinthan  
Affiliation:  Wichita State University  

Cyber-Physical System modeling and contingency assessment for control center applications  
Speaker:  Qinglai Guo  
Affiliation:  Tsinghua University  

Experience of system restoration planning and its implication to communication system design  
Speaker:  John Jiang  
Affiliation:  University of Oklahoma  

Risk-aware operation of cyber-physical power systems: unreliable system protection schemes  
Speaker:  Simon Tindemans  
Affiliation:  Imperial College London  

TBD  
Speaker:  Milorad Papic  
Affiliation:  Idaho Power  

Hybrid control network intrusion detection system for automated distribution systems
Non-uniform reliability in developing power systems
Sponsoring Committee: (PSACE) Reliability and Risk Analysis

Session Chair: Chris Dent, Durham University
Session Chair: Barry Rawn, Brunel University

Reliable electricity supplies are a key enabler of economic development. This panel will explore issues faced in planning and operating systems for reliability in developing countries, including quantifying value of reliability, the meaning of reliability in regions where a large proportion of the population does not have access to grid electricity and where load is allocated rather than supply being optimized, how methods for analysis need to be specialized to a developing country context, and data availability for quantitative evaluation. Panel members speak from industrial, academic, and regulatory/legal perspectives.

Revisiting standard indices like SAIFI and SAIDI in networks where load shedding dominates
Speaker: Ronald Herman
Affiliation: University of Cape Town

Contribution of renewables in developing power systems: experience from Kenya and Ghana
Speaker: Gruffudd Edwards
Affiliation: Durham University
Panelist: Gruffudd Edwards, Chris Dent

Regulator-TSO cooperation on Reliability: Compare and contrast between AESO (Alberta) and TCN (Nigeria)
Speaker: Marcel Martin
Affiliation: Manitoba Hydro International

Tariff design for shortages and the role of the regulator in assessing adequacy
Speaker: Denise Parrish
Affiliation: Wyoming Public Service Commission

Framework of Sustainable Energy System: Green and Reliable Perspectives
Sponsoring Committee: Energy Development and Power Generation

Session Chair: Paulo Ribeiro, Federal University of Itajubá (UNIFEI), Brazil
Session Chair: Jianwei (Jay) Liu, PJM Interconnection LLC

In the past decades, sustainable energy systems have been developed all around the world, from philosophical discussion to real world implementation. More and more successful renewable energy development cases have shown the impact of sustainable energy in the society. With the nature of renewable energy, and under the constraints of current technologies, challenges of reliability and efficiency in power grids with high penetration of renewable energy resources also highlights the upfront work of power engineers. This Panel calls interdisciplinary discussions on the frame work of sustainable energy system, with the insights from academia, public policy and real world project development perspectives. This panel will be a follow-up session based upon previous works and panel discussions within this WG.

The Concept of Normativity Applied to the Design of Sustainable Smart Grids
Speaker: Paulo Ribeiro
Affiliation: Federal University of Itajubá (UNIFEI), Brazil

Sustainable Energy System Development in China
Speaker: Ji Li
Affiliation: Energy Research Institute of NDRC
Panelist: Ji Li, Ming Ni

SunShot Vision of Integrating 100s GW of Solar Energy into Electric Power Systems
Speaker: Guohui Yuan
Affiliation: Department of Energy, EERE-SunShot Initiative
Panelist: Guohui Yuan

Developing Sustainable Energy Services- ConEd's Best Practices
Speaker: Christine Nevin
Affiliation: ConEdison Development
Panelist: Christine Nevin, John Lab

Balancing Sustainability and Reliability - A Modern Power Grid's Perspective
Speaker: Jian Zhou
Affiliation: East China Grid Company/SGCC
Panelist: Jian Zhou

Making Aging Infrastructure Sustainable: A Practical Approach
Speaker: Mohammed Ahmed
Affiliation: American Electric Power
Panelist: Mohammed "Gahanna" Ahmed, Ed Caldwell, Marvin Holmes

Sustainability and Reliability - A View Through Integration
Speaker: Jianwei (Jay) Liu
Affiliation: PJM Interconnection LLC
Panelist: Jianwei Liu, Hong Chen
Analytical Research Foundations for the Next-Generation Electric Grid  
Sponsoring Committee: (PSACE) Reliability and Risk Analysis  

Session Chair:  Chris Dent, Durham University  
Session Chair:  Thomas Overbye, University of Illinois at Urbana-Champaign  

This panel will present the outcomes of a major joint US National Academies project to bring together participants from fields of mathematics, computation, and engineering to identify critical areas of mathematical and computational research that must be addressed for the next-generation electric transmission and distribution system, and how current research efforts in these areas worldwide need to be adjusted or augmented. It includes presentations across the whole scope of the project, including data analytics, optimization and control methods, and uncertainty quantification and validation.

Speaker:  Thomas Overbye  
Affiliation:  University of Illinois at Urbana-Champaign  

The role of control in designing smart grids for provable performance - challenge and opportunities  
Speaker:  Marija Ilic  
Affiliation:  Carnegie Mellon University  

On the need for both real and synthetic data  
Speaker:  Robert Thomas  
Affiliation:  Cornell University  

Resilience enhancement enabled through time-synchronized wide area measurements  
Speaker:  Jeff Dagle  
Affiliation:  Pacific Northwestern National Laboratory  

Commercializing new analytics  
Speaker:  Ralph Masiello  
Affiliation:  DNV GL  

Cascading Outages - Dynamics, Protection, Validation and Data  
Sponsoring Committee: (PSACE) Computer Analytical Methods  

Session Chair:  Alex Flueck, Illinois Institute of Technology  
Session Chair:  Paul Hines, University of Vermont  

Cascading outages cause large blackouts and involve both protection failures and power system dynamics in complicated ways, but these aspects are poorly represented in cascading models. Moreover, the gap between
cascading models and reality, and the approximations most appropriate for analyzing cascading, are not well understood.

Cascading failures typically include three propagation factors: 1) stressed operating conditions, 2) unstable dynamics, and 3) multiple protection operations, some of which might be misoperations. In the State of Reliability 2014 report, NERC staff found protection system misoperations were a significant contributor to the severity of transmission outages.

To explore the complicated relationships between protection systems, dynamics, modeling and cascading failures, a panel of experts from industry and academia will address the following questions:
1. How do we model protection and dynamics in a way that is practical to analyze cascading?
2. How do we validate those models with real data and construct benchmarks?

Massive Transient Stability Based Cascading Analysis and On-line Identification of Critical Cascades
Speaker: Marianna Vaiman
Affiliation: V&R Energy

Benchmarking and Validation: Industry Examples
Speaker: Stephen Miller
Affiliation: Commonwealth Associates, Inc.

Translating data from cascading failure simulations into actionable information using influence graphs
Speaker: Paul Hines
Affiliation: University of Vermont

Seeking cascading realities by processing historical cascades
Speaker: Ian Dobson
Affiliation: Iowa State University

What’s next? High-fidelity power system dynamics and protection simulation
Speaker: Alex Flueck
Affiliation: Illinois Institute of Technology

Automated Mitigation of Cascading Failure in Power Systems
Speaker: Eduardo Cotilla-Sanchez
Affiliation: Oregon State University

Real-Time Predictive Mitigation of Cascades Related to Protection Relaying
Speaker: Greg Zweigle
Affiliation: Schweitzer Engineering Laboratories

Numerical techniques for dynamic probabilistic risk assessment of cascading outages
Speaker: Pierre Henneaux
Affiliation: Tractebel Engineering
Definition of initiating events including protection misoperation for
dynamic studies of cascading outages
Speaker: Andrea Pitto
Affiliation: RSE

The Benefits of CIM Standards in Managing BIG Data of Transmission &
Distribution Systems
Sponsoring Committee: (PSACE) Computer Analytical Methods
Session Chair: Margaret Goodrich, SISCO
Session Chair: Enamul Haq, California ISO

Architecting CIM and Big Data to deliver an Agile SmartGrid
Speaker: Carl Ozkaynak
Affiliation: UISOL an Alstom Company
Panelist: Carl Ozkaynak

Asset Risk Management using CIM with DTE
Speaker: Fook-Luen Heng
Affiliation: IBM
Panelist: Fook-Luen Heng

CIM for Asset Registry and Big Data Asset Health Analytics
Speaker: Gowri Rajappan
Affiliation: Doble Inc
Panelist: Gowri Rajappan

The Role of Big Data Technology in Utility Enterprise Data Management
Speaker: James Meyer
Affiliation: Xtensible Solutions
Panelist: James Meyer

Powering Africa’s emerging economies: An assessment of Technology
advancements and lessons Learned from the global economy
Sponsoring Committee: Energy Development and Power Generation

Powering Africa’s emerging economies: An assessment of Technology
advancements and lessons Learned from the global economy.
Session Chair: Bai Blyden, Not Provided

Cyber Physical System Security for Smart Grid: Methodology and Metrics
Sponsoring Committee: (PSACE) Computer Analytical Methods
Session Chair: Manimaran Govindarasu, Iowa State University
Session Chair:  Adam Hahn, Washington State University

Cyber physical system (CPS) security of the power grid encompassing attack detection, mitigation, and resilience is a timely and important area of research that have significant societal impacts. To further R&D in the area of cyber security for the smart grid, a well-defined set of CPS metrics that combine the cyber and physical properties of the system and pragmatic scientific methodologies that analyze the performance and security of the system against these metrics need to be developed. The goal of this panel session is to advance the state-of-the-art research in the area of CPS security metrics and methodology for the smart grid by bringing experts with diverse, interdisciplinary background and experience to generate lively discussion and identify key directions in this area.

Resiliency metrics and methodology for power grid
Speaker:  Massoud Amin
Affiliation:  University of Minnesota

Cyber security operational metrics for the power grid
Speaker:  Paul Skare
Affiliation:  PNNL

False data injection into State Estimators - Part I
Speaker:  Pete Sauer
Affiliation:  University of Illinois

False data injection into State Estimators - Part II
Speaker:  Rakesh Bobba
Affiliation:  Oregon State University

Testbed-Based Methodology for Cyber-Power System Security
Speaker:  Chen-Ching Liu
Affiliation:  Washington State University

Cyber physical smart grid resilience
Speaker:  Deepa Kundur
Affiliation:  University of Toronto

Towards cyber-physical intrusion tolerance in power grid critical infrastructures
Speaker:  Saman Zonouz
Affiliation:  Rutgers University

High Performance Computing for Grid Operations - What Can be Learned from Other Fields?
Sponsoring Committee:  (PSACE) Computer Analytical Methods

Session Chair:  John Grosh, Lawrence Livermore National Laboratory

Abstract:  What can be learned about the application of advanced computing and high performance computing from disciplines outside of...
power engineering? This panel will explore how the power engineering community might (or might not) be able to leverage approaches employed within other fields focused on mission critical deadline-driven calculations. In power engineering, such calculations range from state estimations and contingency analysis used within energy management systems to production cost modeling for day-ahead planning. Outside of the power engineering discipline, applications such as radar processing and weather forecasting have used advanced computing to support mission operations. Panel members will explore how elements of advanced computing (e.g., computing architectures, algorithms, software, and models) are used within the power grid community for operations, discuss research challenges and issues for grid operations, provide two presentations from ‘adjacent’ fields on applications and lessons learned, and draw conclusions on approaches for leveraging.

HPC Multi-rate Real-time Hardware-in-the-Loop Simulation Challenges and Actual Solutions for Large Interconnected Systems: Power Grids, Microgrids, Electrical Aircraft and Ships
Speaker: Jean Belanger
Affiliation: OPAL-RT

Parallel Computing Standards: Seven Good Reasons
Speaker: Jeremy Kepner
Affiliation: MIT Lincoln Laboratory

Energy Forecasting, Demand Response, Grid Services & High Penetration Renewables
Speaker: Steve Hammond
Affiliation: National Renewable Energy Laboratory

Navigating Grid Complexity: a Role of Advanced Computing
Speaker: Zhenyu Huang
Affiliation: PNNL

Research on Preventing Cascading Outages with Faster than Real-Time Simulation
Speaker: Alex Flueck
Affiliation: Illinois Institute of Technology

Power Grid Resilience: Fast Recovery from Extreme Events
Sponsoring Committee: (PSACE) Computer Analytical Methods

Session Chair: Wei Sun, University of Central Florida
Session Chair: Yunhe Hou, University of Hong Kong

Critical power infrastructure has to operate against extreme events, like long-term climate change, natural hazards and disasters, cyber intrusion, etc. Fast recovery and successfully adapting to extreme events are critical to build a resilient power grid. Recent advances on smart grid technologies bring both opportunities and challenges for system operators to enhance system reliability and resiliency. This panel will summarize
recent developments in advanced computational models and analytical methods in power system restoration, and industry practice and training procedure. It will also discuss challenges from new technologies, such as, renewable energy, PMU, microgrids, etc. Our diversified panelists are from both academia and industry, including, universities, ISOs, and utilities from U.S. and Asia. They will provide a comprehensive review of the state-of-the-art and discuss future directions to power grid resilience.

Microgrid's Impact on Power Grid Resilience
Speaker: Chen-Ching Liu
Affiliation: Washington State University

Enhancing Resilience with Microgrid Clusters
Speaker: Yunhe Hou
Affiliation: University of Hong Kong

Grid Restoration through Advanced Optimization and Microgrids Formation
Speaker: Jianhui Wang
Affiliation: Argonne National Laboratory

PJM System Restoration Strategy Plan and Automation
Speaker: Jianzhong Tong
Affiliation: PJM Interconnection

Real-time Computational Techniques in System Restoration
Speaker: RUI SUN
Affiliation: Dominion Virginia Power
Panelist: Rui Sun, Mutmainna Tania

Power System Restoration from Extreme Weather using Renewables
Speaker: Wei Sun
Affiliation: University of Central Florida

Latest Advances in Applications of Optimization Algorithms and Computational Techniques to Power System and Electricity Market
Sponsoring Committee: (PSACE) Computer Analytical Methods

Session Chair: Jeremy Lin, PJM Interconnection

Challenges in Solving AC-OPF towards Volt/VAR Support as New Ancillary Services in Energy Markets
Speaker: Fernando Magnago
Affiliation: Nexant Inc.,
Panelist: Fernando Magnago

Experiences with Addressing Computational Challenges on Large Scale Power Systems Optimization Problems
Speaker: Ying Xiao
Affiliation: Alstom Grid
Application of High Performance Computing on Quantifying the Benefits of Transmission Topology Control in Balancing Renewable Supply Variability: A Case Study of Europe
Speaker: Anthony Papavasiliou
Affiliation: Université catholique de Louvain

Applying a New Scenario Decomposition Algorithm to Solve Stochastic Unit Commitment Problems
Speaker: Deepak Rajan
Affiliation: Lawrence Livermore National Laboratory

Hierarchical Optimization for Distributed Marginal Pricing
Speaker: Mohammad hesamzadeh
Affiliation: KTH Royal Institute of Technology

A Synergistic Combination of Surrogate Lagrangian Relaxation and Branch-and-Cut for MIP Problems in Power Systems
Speaker: Peter Luh
Affiliation: University of Connecticut

**Big Data Empirical Assessment of Demand Response**
**Sponsoring Committee: (PSACE) Intelligent Systems**

Session Chair: Haiwang Zhong, Tsinghua University
Session Chair: Baosen Zhang, University of Washington

**Big Data Era in Power Distribution Networks**
**Sponsoring Committee: (PSACE) Intelligent Systems**

Session Chair: Reza Arghandeh, Florida State University

In this panel, we will bring together researchers, industrial representatives, government agencies, and stakeholders to discuss the big data analytics applications for power distribution networks diagnostics, operation and control. We will focus on rapidly modernizing monitoring systems, measurement data availability, big data handling, and analytical approaches to process the high dimensional, heterogeneous, and spatiotemporal data. Our panelists will discuss challenges, opportunities, success stories, and pathways for utilizing big data value in power distribution networks.

The role of data in highly granular system control and optimization
Speaker: Timothy Heidel
Affiliation: U.S. Department of Energy

Utility insight into big data - Challenges, opportunities, and applications for DER integration
Speaker: Jun Wen
Affiliation: Southern California Edison
Machine Learning Approaches for Event Detection in Distribution Networks with Partial Knowledge
Speaker: Reza Arghandeh
Affiliation: Florida State University

Smart Customer Application with Big Data Analytics in Distribution Network
Speaker: Feng Gao
Affiliation: State Grid Smart Grid Research Institute North America Inc.

Visualization and Insight for Demand and Distributed Energy Resources Management
Speaker: Ram Rajagopal
Affiliation: Stanford University

Intelligent smart grid management using smart metering and PMU data
Sponsoring Committee: (PSACE) Intelligent Systems
Session Chair: Zita Vale, Polytechnic of Porto

This panel addresses the use of smart meters and PMU Data to support smart grid management. The panel presents the current state reporting real applications in these areas and possible future applications. The panel will discuss the vision for the future on how to transform data from smart meters and PMU into knowledge to be used for smart grid operation and planning.

Situational Intelligence for Synchrophasor Information
Speaker: G. G. Kumar Venayagamoorthy
Affiliation: Clemson University

SEAS - An Open Source IT Platform to Manage Energy
Speaker: Philippe Calvez
Affiliation: ENGIE

A multi-agent based approach for intelligent microgrid operation
Speaker: Zita Vale
Affiliation: Polytechnic of Porto

A complex system approach for behavioral economic analysis of consumers in smart grid
Speaker: Luciano Cavalcante Siebert
Affiliation: Lactec Institute

Intelligent Demand Response Management and Control
Sponsoring Committee: (PSACE) Intelligent Systems
Creating Conscious and Market for Negawatt Commodity
Speaker:  Kumar Venayagamoorthy
Affiliation:  Clemson University

Effective management of demande response in smart grids using consumers’ aggregation and clustering
Speaker:  Zita Vale
Affiliation:  Polytechnic of Porto

Demand Response Practices and Distribution System impacts
Speaker:  Visvakumar Aravinthan,
Affiliation:  Wichita State University

Modern Heuristic Optimization Techniques for Optimal Planning of Sustainable Transmission and Distribution Systems
Sponsoring Committee:  (PSACE) Intelligent Systems

The transition towards sustainable electrical power systems demands an adaptation of transmission and distribution systems to cope with the variability and geographical dispersion of renewable generation, which jeopardizes the operational economy and reliability. The adaptation involves the planning of important grid modifications that have strong influence on real-time operation and control. This panel aims at addressing the following issues related to optimal planning of sustainable transmission and distribution systems:

i) Opportunities and challenges to the planning of offshore transnational grids.

ii) Implications of the emergence of active distribution systems, and the integration of unconventional technologies on optimal transmission planning.

iii) An overview and discussion on the formulation complexities, scalability, and solution challenges of the optimal transmission planning problem under high uncertainty.

iv) Case studies, performance comparison, and experience with the application of classical, heuristic, and hybrid optimization algorithms.

Opportunities and challenges to the planning of offshore transnational grids
Speaker:  Mart van der Meijden
Affiliation:  TenneT TSO B.V.

New approach for planning hydrothermal systems
Speaker:  Cristian Díaz-Durán
Affiliation:  XM S.A. E.S.P.
Panelist:  Cristian Díaz-Durán

MVMO for optimal short-term transmission planning and control
Multi-objective Meta-heuristic Method for Distribution Network Reconfigurations
Speaker: Hiroyuki Mori
Affiliation: Meiji University
Panelist: Hiroyuki Mori, H. Yokoyama

Computational Capacity Planning in Electricity Networks
Speaker: J.A. La Poutré
Affiliation: CWI Amsterdam - TU Delft
Panelist: J.A. La Poutré

Hierarchical Approach to Multi-objective Conservation Voltage Reduction Planning
Speaker: Kwang Lee
Affiliation: Baylor University

Marine and Hydrokinetic (MHK) Generation
Sponsoring Committee: Electric Machinery
Session Chair: Eduard Muljadi, NREL

This panel will discuss various aspects of marine and hydrokinetic generation in a panel discussion forum. It will cover diverse topics in Marine and Hydrokinetic (MHK) Generation (wave, tidal, and stream-based technologies) including the prime mover design, electrical energy conversion, control strategies, power plant planning (resource assessment) and operation, testing, and grid integration. The panelists include representatives from research centers, universities, device manufacturers, project developers, and utilities from the international community.

Overview of Marine Hydrokinetic
Speaker: Robert Thresher
Affiliation: National Renewable Energy Laboratory

Sabella D10 - tidal turbine pilot power plant
Speaker: Jean-Christophe Allo
Affiliation: Sabella

Slider crank type wave energy converter
Speaker: Bora Karayaka
Affiliation: West Carolina University

Wave energy converter: Generator and Prototype Testing
Speaker: Ken Rhinefrank
Affiliation: Columbia Power Technologies

Design of Energy Storage for Wave Energy Converter
Speaker: Jamie Chapman
Operating the power system without synchronous generators
Sponsoring Committee: Electric Machinery

Session Chair: Robert Nelson, Siemens

This panel will discuss means of controlling power and voltage on an ac grid without the use of synchronous machines. As the penetration of variable renewable generation resources increases and older fossil plants are retired, it is expected that some parts of the interconnected system will have weak connections to synchronous generating plants. This panel will describe means of controlling frequency, voltage and power transfer without the use of synchronous generators, including the use of converters operated as virtual synchronous generators and dc terminals with frequency regulation capabilities. Panelists will include system analysts and academics.

Towards a non synchronous system, experience from Ireland
Speaker: Mark O'Malley
Affiliation: UCD
Panelist: Mark O'Malley

Operational challenges of a grid with only inverter-interfaced wind farms: frequency dynamics considerations
Speaker: Nilanjan Ray Chaudhuri
Affiliation: North Dakota State University

Virtual Synchronous Machine (VISMA)
Speaker: Dirk turschner
Affiliation: Technical University Clausthal
Panelist: Dr.-Ing. Dirk Turschner, Prof. Dr.-Ing. Hans-Peter Beck

Power Electronics-enabled Autonomous Power Systems
Speaker: Qing-Chang Zhong
Affiliation: Illinois Institute of Technology
Panelist: Qing-Chang Zhong

Dynamic behavior of inertialess offshore grids following interruption of the HVDC link
Reactive power capabilities of wind turbine generators and representation in load flow studies
Sponsoring Committee: Electric Machinery

Session Chair: Matthew Richwine, General Electric

This panel will discuss the reactive power capability of wind turbine generators and the approaches for representing the capability in commonly used load flow programs. Proper representation of wind turbine generator reactive capability for use in interconnection studies is important as it impacts overall wind plant design, particularly around the use of supplementary VAr devices. Panelists will include wind turbine OEMs, system analysts, software program developers, and academics.

Modeling wind turbine Reactive Limits in power flow studies
Speaker: Brian Thomas
Affiliation: GE Energy Consulting

Advanced voltage controls for a wind power plant
Speaker: Eduard Muljadi
Affiliation: NREL

WPP Design and Control for Meeting Reactive Power Grid Code Requirements for Continuous Dynamic Performance at the PCC
Speaker: Steven Saylors
Affiliation: Vestas

Reactive power capability and control specification for wind generators
Speaker: Abraham Ellis
Affiliation: Sandia National Labs

Reactive Power Capability of Wind Turbines based on Doubly-Fed Induction Generators
Speaker: István Erlich
Affiliation: Duisburg-Essen University
Coordination of Grid Codes and Generator Standards: Consequences of Diverse Grid Code Requirements on Synchronous Machine Design and Standards
Sponsoring Committee: Electric Machinery

Session Chair: Robert Thornton-Jones, BRUSH Turbogenerators

This panel will review the impact of new and varied grid code requirements on the design of turbogenerators, and the need for changes in the associated international equipment standards. The panelists include representatives from grid operators and regulators, generation operators, equipment manufacturers, and utilities from the international community.  
Expected Attendance: 50

Is your panel session similar to the subject matter of one of the super sessions?: False
If yes, which one:

Generator Capability Envelope and Design Challenges to Accommodate Grid Code Requirements
Speaker: Kevin Mayor
Affiliation: General Electric (Switzerland) GmbH
Panelist: Kevin Chan, Bob Cummings, Thong Vu Van

The Impact of System Fault Related Grid Code Requirements Upon Generator Design and Generator Standards
Speaker: Luis Rouco
Affiliation: Comillas University
Panelist: Bob Cummings, Kevin Chan, Robert Thornton-Jones

The Impact of Grid Codes Upon Generator Excitation System Design and Standards
Speaker: Les Hajagos
Affiliation: Kestrel Power Engineering
Panelist: Leonardo Lima, Robert Thornton-Jones

Advances in IEEE Test Systems for Economic Analysis
Sponsoring Committee: (PSACE) Economic Systems

Session Chair: Xiao-Ping Zhang, University of Birmingham

Test systems provide validated contexts and can provide ‘standardized’ data for economic analysis of electric power systems, analogous to the IEEE reliability test systems. This panel will review ways in which test systems have been applied to real-world situations and lessons learned from them, as well as open issues in which the application of test systems can help in understanding remaining unresolved problems. Discussions will include methodologies to derive test systems by model reduction of ‘real’ systems and to amend available smaller systems with economic data. Gaps between existing test system models and the needs for IEEE test systems for economic analysis will be explored.
Evaluation of system flexibility based on unit commitment parameter definition - scenario with high penetration of variable renewable sources in the Chilean system
Speaker: Rodrigo Palma-Behnke
Affiliation: University of Chile
Panelist: Rodrigo Palma-Behnke, Rigoberto Torres-Avila

System with Large Scale Integration of Wind Energy
Speaker: Xiao-Ping Zhang
Affiliation: University of Birmingham
Panelist: Xiao-Ping Zhang, Peter Zeng, Zhi Wu

Perspectives on Modeling Market Interactions in Face of an Evolving Resource Mix
Speaker: Jim Price
Affiliation: California ISO

Using an Integrated Retail and Wholesale (IRW) Power System Test Bed to Explore the Dynamic Effects of Price-Responsive Retail Contracts
Speaker: Leigh Tesfatsion
Affiliation: Iowa State University
Panelist: Auswin Thomas, Leigh Tesfatsion

Creating a novel standard benchmark for smart grid coordination approaches to balancing
Speaker: Koen Kok
Affiliation: TNO, The Netherlands

Sustainable Rural Development in the context of SE4ALL - progress and impacts
Sponsoring Committee: (PSACE) Economic Systems

Session Chair: Joseph Mutale, University of Manchester

It is now three years since the UN Secretary General Ban Ki-moon declared 2012 the International Year of Sustainable Energy for ALL aptly dubbed SE4ALL. This panel will bring together speakers from the most influential players in rural development and electrification including the United Nations (UN) itself, the World Bank as well as policy makers and implementers from developing countries to discuss the current status of electricity supply in developing communities. In particular the panel will assess the impact of SE4ALL in the context of several initiatives that have been taken thus far, focusing on impacts on rural development.

Is a Grassroots Development Strategy for Electrification Needed for SE4ALL?
Speaker: Martin Niboh
Affiliation: Torchbearer Foundation

Geo-spatial electrification planning: what it is, it’s role and impacts to-date
Speaker: Rhonda Jordan  
Affiliation: World Bank

Micro Grids for Energy Access: Aligning interests and incentives  
Speaker: Gunjan Gautam  
Affiliation: World Bank

Sustainable energy technologies and policy  
Speaker: Jem Porcaro  
Affiliation: UN Foundation

First energy access - off-grid consumption patterns in developing countries  
Speaker: Peter Dauenhauer  
Affiliation: University of Strathclyde

New Challenges of Pricing Active Distribution Network  
Sponsoring Committee: (PSACE) Economic Systems

Session Chair: Jose Marangon-Lima, Universidade Federal de Itajubá

Session Chair: Narayan Padhy, IIT Roorkee

Challenges of Distribution Pricing in Brazil  
Speaker: Jose Marangon-Lima  
Affiliation: Universidade Federal de Itajubá  
Panelist: Jose Marangon-Lima

Clustering Based Reduced Distribution Network Model for Active Network Pricing  
Speaker: Narayan Padhy  
Affiliation: IIT Roorkee

Coevolution of Community Energy Markets, Active Network Management and Distribution Network Pricing  
Speaker: Furong Li  
Affiliation: University of Bath  
Panelist: Furong Li

Distribution network pricing in China  
Speaker: Chongqing Kang  
Affiliation: Tsinghua University  
Panelist: Chongqing Kang, Yi Ding, Qixin Chen

Benchmark pricing regulation: the challenges of distributed generation  
Speaker: Hugh Rudnick  
Affiliation: Pontificia Universidad Catolica de Chile  
Panelist: Hugh Rudnick

Distribution network pricing in China  
Speaker: Yi Ding  
Affiliation: Zhejiang University
Distribution Simulations at Varying Time Scales
Sponsoring Committee: (PSACE) Distribution System Analysis

Session Chair: Kevin Schneider, Pacific Northwest National Laboratory

The majority of traditional distribution simulations have been confined primarily to static power flow simulations, but this is beginning to change as smart grid technologies are increasingly deployed. This panel will examine the new distribution level simulations that are being conducted which include quasi-static time-series simulations and dynamic simulations. These simulations vary from those run at the transmission level because of the inherently unbalanced nature of distribution systems, and the potential for single and double phase laterals. These new simulations will be an essential part of modernizing electric power systems.

Time-Series Simulations to Evaluate Mitigation Strategies for High Penetrations of PV
Speaker: Jason Fuller
Affiliation: Pacific Northwest National Laboratory

Comparison of Distribution-Connected PV Impact Studies: Steady-State and QSTS Hosting Capacity Analysis
Speaker: Barry Mather
Affiliation: NREL

Envisioning Future Distribution Grid with High Penetration of Electrical Vehicles
Speaker: J.K. Wang
Affiliation: OSU

Three-Phase Dynamic Analysis of a Hybrid Transmission and Distribution Model: Impact of PV on Dynamics
Speaker: Jason Bank
Affiliation: EDD

Fault Analysis on Distribution Feeders with High Penetration of PV Systems
Speaker: Mesut Baran
Affiliation: NCSU

Stochastic Modeling and Analysis of Distribution Systems/Microgrids
Sponsoring Committee: (PSACE) Distribution System Analysis

Session Chair: Sarika Khushalani-Solanki, West Virginia University
Session Chair: Roger Dugan, EPRI
Measurements and Their Integration Challenges for Distribution State Estimation
Sponsoring Committee: (PSACE) Distribution System Analysis
Session Chair: Liuxi (Calvin) Zhang, Nexant, Inc.

Use of the new revisions of IEEE Standards 421.2 and 421.5 to satisfy international grid code requirements
Sponsoring Committee: Energy Development and Power Generation
Session Chair: Les Hajagos, Kestrel Power Engineering

- Use of the new revisions of IEEE Standards 421.2 and 421.5 to satisfy international grid code requirements.
- In North America, we have the MOD and PRC Standards in place. In other regions around the world, similar grid code have similar requirements.
- Excitation System SC will report on our many recent activities related to testing and modeling of excitation systems, associated controllers and limits to support meeting these requirements.

Speaker: Les Hajagos
Affiliation: Kestrel Power Engineering

Industry Experience with Provision of Synthetic Grid Services from Demand-side Assets
Sponsoring Committee: (PSACE) Economic Systems

Integration of Distributed Energy Resources for Provision of Wholesale Market Products
Speaker: Ralph Masiello
Affiliation: Quanta Technology
Panelist: Ralph Masiello

Provision of Synthetic Frequency Regulation from Demand-side Assets
Speaker: Farrokh Albuyeh
Affiliation: OATI
Panelist: Farrokh Albuyeh

Co-optimization of Utility Storage and Demand Response for Provision of Grid Services
Speaker: Robert Sherick
Affiliation: SCE
Panelist: Robert Sherick

Is Transactive Energy Cost Effective for Provision of Grid Services?
Speaker: Christofer Irwin
Affiliation: DOE
Panelist: Christofer Irwin

Peer-to-peer Local Energy Market Design: Providing Grid Services from Demand-side Assets
Speaker: Rohit Bhakar
Affiliation: University of Bath, U.K.
Panelist: Rohit Bhakar, Furong Li

Condition Monitoring of Electrical Machines
Sponsoring Committee: Electric Machinery

Session Chair: Dan Ionel, University of Kentucky
Session Chair: Prabhakar Neti, General Electric

Some latest methods of conditioning monitoring, thermal management and acoustic noise of electric machines will be presented by experts in this area. The latest technologies in these motors and drives will be presented by the panelists.

A Novel Scheme for Online Health Monitoring of Industrial Motor Insulation HSCT MSIM
Speaker: Prabhakar Neti
Affiliation: General Electric

Electrical Signature Analysis Based Online Monitoring of Drive-trains
Speaker: Prabhakar Neti
Affiliation: General Electric

Generator Health Monitor (GHM)
Speaker: Prabhakar Neti
Affiliation: General Electric

Failure Diagnosis for Demagnetization in Permanent Magnet Synchronous Motor
Speaker: Takeo Ishikawa
Affiliation: Gunma University

Condition Monitoring of Brushless Synchronous Generators Using Auxiliary Supply Winding
Speaker: S. Panda
Affiliation: National University of Singapore

Generator Health Monitor (GHM)
Speaker: Prabhakar Neti
Affiliation: General Electric

Electrical Signature Analysis Based Online Monitoring of Drive-trains
Speaker: Prabhakar Neti
Affiliation: General Electric
A Novel Scheme for Online Health Monitoring of Industrial Motor
Insulation HSCT MSIM
Speaker: Prabhakar Neti
Affiliation: General Electric

Condition Monitoring and Fault Detection in the Stator of Electrical Machines
Speaker: Osama Mohammed
Affiliation: Florida International University

Electrical Signature Analysis Based Online Monitoring of Drive-trains
Speaker: Prabhakar Neti
Affiliation: General Electric

Generator Health Monitor (GHM)
Speaker: Prabhakar Neti
Affiliation: General Electric

A Novel Scheme for Online Health Monitoring of Industrial Motor
Insulation HSCT MSIM
Speaker: Prabhakar Neti
Affiliation: General Electric

Advanced Motors and Drives for Electric Vehicles and Harsh Environments
Sponsoring Committee: Electric Machinery

Session Chair: Thomas Wu, University of Central Florida
Session Chair: Iqbal Husain, North Carolina State University

There is active research and development in electric motors for HEV/EV and applications in harsh environment. Panelists will present the latest research and developments of some unique machine structures, switched reluctance motors, flux switching machines, and power converters.

Development of a Rare-Earth-Free SR Motor With High Torque Density for Hybrid Vehicles
Speaker: Akira Chiba
Affiliation: Tokyo Institute of Technology

Improving Range Estimation Model of Electric Vehicles Considering Efficiency Analysis of Electric Traction Motor Drives
Speaker: Kashem Muttaqi
Affiliation: University of Wollongong

Rotor Position Speed Sensorless Control for Permanent-Magnet Synchronous Machines
Speaker: Wei Qiao
Affiliation: University of Nebraska-Lincoln

A Novel 6-Slot 4-Pole Flux-Switching Permanent Magnet Machine for Efficient Energy Conversion
Speaker: Bulent Sarlioglu  
Affiliation: University of Wisconsin - Madison

Soft Starting of Electric Submersible Pump DRIVES for Harsh Envirmont in Oceans  
Speaker: M. Rahman  
Affiliation: Memorial University of Newfoundland

Rotor Converter for Long Step-out Subsea Power Supply  
Speaker: Yao Duan  
Affiliation: Aker Solutions

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**Advanced Topics in Electrical Machines**  
**Sponsoring Committee: Electric Machinery**

Session Chair: Masahide Ooshima, Tokyo University of Science, Suwa  
Session Chair: Saleh Saleh, UNB

Electric machines have been advanced in several aspects. Bearingless motors are magnetically suspended motor. Advances in asymmetric permanent magnet motors, wound field machine are also presented by experts in this field.

Study of Field Characteristic at Different Voltage Synchronization  
Speaker: Daisuke Hiramatsu  
Affiliation: Toshiba

Ride-Through of DFIG Operation at Dead-band around Synchronous Speed  
Speaker: Kashem Muttaqi  
Affiliation: University of Wollongong

Design and Performance of a ſI-Shaped Interior Permanent Magnet Generator  
Speaker: Saleh Saleh  
Affiliation: UNB

Optimal Design of Electronically Controlled SynRel and SynRelPM Motors  
Speaker: Dan Ionel  
Affiliation: University of Kentucky

Magnetically Suspended Single-Drive Bearingless Motor with Soft Magnetic Composite  
Speaker: Hiroya Sugimoto  
Affiliation: Tokyo Institute of Technology

Analysis of SiC Based Power Electronic Inverters for High Speed Machines  
Speaker: Bulent Sarlioglu  
Affiliation: University of Wisconsin - Madison

Estimation of Transient Current for Stable Rotor Levitation in a Time-divided Torque and Suspension Force Control Type Bearingless Motor  
Speaker: Masahide Ooshima
As renewable resources become prevalent and new loads including electric vehicles emerge, future resource portfolios are likely to include energy storage systems. Incentives including $185 million of Federal funding induced by ARRA and leveraging additional $585 million in cost-sharing have already accelerated deployments of energy storage systems.

Topics include:
- How well energy storage performs from both technical perspectives (following control signals, durability and capacity fading), as well as from value creation perspectives,
- How storage resources can participate in markets,
- Impacts on organized markets,
- Business models to best integrate storage,
- Implications for technologies and project sizes, decision tools for resource developers and market operators, and integration strategies. Different network interconnections may mean multiple answers. Responding primarily to regulatory requirements, significant amounts of storage have been grid-connected at transmission voltages, while increasing numbers of deployments will be done at distribution level or as part of Microgrids, or behind customers’ meters.

Introduction: Models, Value, and Performance of Energy Storage
Speaker: Jim Price
Affiliation: California ISO
Panelist: Jim Price

Analysis of Market and Non-Market based Revenue Sources of Energy Storage Resources
Speaker: Alex Papalexopoulos
Affiliation: ECCO international
Panelist: Alex Papalexopoulos

Leveraging Distributed Storage for Provision of Grid Services and Tradable Products
Speaker: Farrokh Rahimi
Panelist: Farrokh Rahimi
Energy Storage Procurement in Vertically-Integrated and Competitive Market Environments  
Speaker: Daniel Kirschen  
Affiliation: University of Washington  
Panelist: Daniel Kirschen  

Market Opportunities and Performance Requirements for Behind-the-meter Energy Storage Providing Grid Services  
Speaker: Michael Kleinberg  
Affiliation: DNV GL  

Valuation of Energy Storage and Real-World Test Results  
Speaker: Patrick Balducci  
Affiliation: Pacific Northwest National Laboratory  

Advanced Inverter Functions for Massachusetts Solar Carve-Outs and Renewable Portfolio Standards  
Sponsoring Committee: Local Organizing Committee  
Session Chair: Tom McDermott, University of Pittsburgh  
This panel will address implementation strategies for the new inverter functions enabled by a recent amendment to IEEE Standard 1547, and as envisioned by the ongoing full revision of the standard. We will present new methods, practical methods for design and settings, and case studies from both vendor and utility/user perspectives. These advanced functions will enable distributed solar generation to reach ever-higher levels on distribution circuits. In turn, this will help Massachusetts achieve its Solar Carve-Out and RPS targets for renewable energy generation in the commonwealth.  

Superconductors in Grid Modernization: Experiences from a MA Manufacturer and Utilities  
Sponsoring Committee: Local Organizing Committee  
Session Chair: Michael Ross, AMSC  
High Temperature Superconductor technologies have long shown potential for a substantial role in the modernization of urban electric grids in New England and other major cities. Recently, Eversource in Boston and PEPCO in Washington, DC have announced plans to investigate applications of HTS technologies in their networks. Utilities in the US (ComEd, Chicago), South Korea (KEPCO, Seoul), and Germany (RWE, Essen) have signaled growing acceptance of these technologies by pursuing HTS based modernization projects into their grids. High land values in Southern New England pose challenges to utilities, particularly in congested downtown areas. HTS technologies allow compact options where other traditional solutions may not fit.
This panel will discuss utility applications of HTS technologies, the US government’s vision for HTS applications in improving grid resiliency, New England based Eversource Energy’s assessment of the technology, ComEd’s ongoing major HTS cable project in Chicago, and HTS activities in the Republic of Korea.

Superconductor Applications in Grid Modernization
Speaker: Michael Ross
Affiliation: AMSC

US Government's Vision for HTS Applications in Improving Grid Resiliency
Speaker: Sarah Mahmood
Affiliation: US Department of Homeland Security

Eversource Energy’s Assessment of HTS Technology
Speaker: Paul Renaud
Affiliation: Eversource Energy

ComEd's Assessment of HTS Technology
Speaker: Robert Fournie
Affiliation: ComEd

Utility HTS Activities in South Korea
Speaker: Ryan Ryu
Affiliation: LS Cable & System

New England Innovating Technology and Standards for Grid Integration of Distributed Energy Resources and Microgrids
Sponsoring Committee: Local Organizing Committee

Session Chair: Thomas (Tom) Basso, National Renewable Energy Laboratory (NREL)

Paving the way for grid modernization includes effective systems integration of distributed energy resources (DERs) and microgrids. Their safe and reliable integration with the grid will not be substantially realized anytime soon without timely advances and innovative implementation of technology and the foundational codes, standards, and jurisdictional rules governing deployment. Technology advances, new business opportunities, and new legislative or regulatory mandates are contributing factors why DER and microgrid deployments are being forecasted at an accelerated pace. However, technology advances have outpaced the existing codes, standards, and rules for integration. And, new entrepreneurial business opportunities are promised that extend beyond what is mandated or explicitly addressed in existing codes, standards and rules for integration. This panel will provide vision and status on how DER and microgrid technologies, codes, standards and rules are contributing to grid modernization.

DER and Microgrids: Serving Customers – Supporting the Grid
Speaker: Thomas (Tom) Basso
Affiliation: National Renewable Energy Laboratory (NREL)
Panelist: Thomas (Tom) Basso

(Draft) Power Sector Regulation and Market Factors for the Modern Grid
Speaker: Richard Sedano
Affiliation: Regulatory Assistance Project

(Draft) ISO-NE power sector perspectives
Speaker: David Forrest
Affiliation: ISO-NE (Retired)

(Draft) Microgrid Controller Testing IEEE draft Standard, and NEC 2017 updates
Speaker: Ward Bower
Affiliation: Ward Bower Innovations, LLC

(Draft) Microgrid and Controller Technology, and IEEE draft Standard
Speaker: Erik Limpaecher
Affiliation: MIT Lincoln Laboratory/Energy Initiative

(Draft) System Integration of DERs and Microgrid Applications.
Speaker: Soonwook Hong
Affiliation: Yaskaw-Solectria Solar

(Draft) Utility Experiences and Perspectives
Speaker: Babak Enayati
Affiliation: National Grid

Future of the grid in MA
Sponsoring Committee: Local Organizing Committee

Session Chair: Judith Judson, MA Department of Energy Resources

The panel will discuss the future of the grid in Massachusetts, including updates and perspectives on Grid Modernization, as well as opportunities and challenges for various distributed energy resources such as clean distributed generation, storage, and electric vehicles.

Future of the Grid in Massachusetts
Speaker: Austin Blackmon
Affiliation: City of Boston
Panelist: Austin Blackmon

Future of the Grid in Massachusetts
Speaker: Steve Pike
Affiliation: Massachusetts Clean Energy Center (MassCEC)

Future of the Grid in Massachusetts
Speaker: Camilo Serna
Affiliation: Eversource Energy
Modernizing Grid Planning with DER in New England: New Methods for Determining Distribution System-Wide Hosting Capacity and Locational Value of DER  
**Sponsoring Committee:** Local Organizing Committee  
**Session Chair:** Jeff Smith, EPRI

With the proliferation of higher levels of distributed energy resources (DER) being deployed into the distribution system, greater emphasis is placed on accurately assessing distribution performance with DER. In many cases, this large amount of DER is interconnecting at the "edge" of the grid, where utilities typically have reduced amounts of visibility and control. Combined with the sheer number of interconnection requests to connect, such constraints create challenges for distribution planners that must ensure power quality and reliability is maintained for all customers. At the same time, with proper controls and coordination, these resources could benefit distribution performance through reducing loading at peak periods, reducing losses, and deferring investment in new capacity. Effective integration of DER creates new requirements for distribution planning and analysis. This panel session will summarize various methods that have been developed and applied throughout the world that can assist distribution planners in addressing these challenges.

**Grid Modernization – Integration and Interoperability of ADMS and Microgrids Including Case Study Examples in Massachusetts**  
**Sponsoring Committee:** Local Organizing Committee  
**Session Chair:** John McDonald, GE Grid Solutions

Two key elements of grid modernization are the Advanced Distribution Management System (ADMS) and microgrids. There is business value for the electric utility for ADMS and microgrids standalone, however, the greater value proposition for the electric utility is when these elements are integrated with devices and systems within the enterprise resulting in an integrated solution that successfully interoperates. Industry consensus believes that 70% of the cost of an ADMS implementation is integration. Successful interoperability requires compliance with industry standards for communications and information exchange. The panel session will focus on how ADMS and microgrids contribute to grid modernization and the importance of integration and interoperability, with perspectives from both manufacturers and utility users. There will be several case study examples from Massachusetts. For example, one case study for system automation from Superstorm Sandy, where more than 100,000 customers in Massachusetts were automatically restored, will be discussed.

**Grid Modernization Key Industry/Societal Trends**  
**Speaker:** John McDonald  
**Affiliation:** GE Grid Solutions  
**Panelist:** Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell
Microgrids Integration and Interoperability
Speaker:  Jayant Kumar
Affiliation:  GE Grid Solutions
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

The Philadelphia Navy Yard Microgrid Project
Speaker:  Will Agate
Affiliation:  Philadelphia Industrial Development Corporation (PIDC)
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

Advanced Distribution Management Systems (ADMS) and Enterprise Integration
Speaker:  Ethan Boardman
Affiliation:  GE Grid Solutions
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

Outage Management Systems (OMS) within Advanced Distribution Management Systems (ADMS) at Southern Company
Speaker:  Bill Mintz
Affiliation:  Alabama Power Company/Southern Company
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

Integrated Volt/VAR Control (IVVC) within Advanced Distribution Management Systems (ADMS) at Duke Energy
Speaker:  Steve Russell
Affiliation:  Duke Energy
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

Fault Location, Isolation and Service Restoration (FLISR) within Advanced Distribution Management Systems (ADMS) at Eversource Energy, with Case Study Examples in Massachusetts
Speaker:  Ken Bowes
Affiliation:  Eversource Energy
Panelist:  Dr. Jayant Kumar, Mr. Will Agate, Mr. Ethan Boardman, Mr. Bill Mintz, Mr. Steve Russell

Applications in New England for Transmission Line Monitoring
Sponsoring Committee:  Local Organizing Committee
Session Chair:  Michael Henderson, ISO-New England

The Transmission Grid in New England faces a range of challenges including: the successful integration of renewable energy resources, the retirement of nuclear and coal generation, and the scheduling of transmission outages. Improved utilization of limited rights-of-way is an additional challenge.
Next-generation transmission line monitoring technologies may provide opportunities for cost-effectively enabling renewable integration, validating models, and improving reliable operation of the system. Panel representatives from utilities, manufacturers and researchers will explore how these technologies increase the resiliency and efficiency of the grid. Panelists will share case studies of current applications. Panelists and attendees can learn and discuss how these and other technologies and applications might be deployed in New England.

Applications in New England for Transmission Line Monitoring
Speaker: Tip Goodwin
Affiliation: ONCOR Electric Delivery
Panelist: Tip Goodwin

Applications in New England for Transmission Line Monitoring
Speaker: Nathan Pinney
Affiliation: Genscape

Applications in New England for Transmission Line Monitoring
Speaker: Dale Douglas
Affiliation: Consultant

Applications in New England for Transmission Line Monitoring
Speaker: Kurt Myers
Affiliation: Idaho National Laboratories

Applications in New England for Transmission Line Monitoring
Speaker: Amsa Mangga
Affiliation: National Grid

Research Priorities and Open Problems in Power Systems Communications and Networking
Sponsoring Committee: Substations

Session Chair: Craig Preuss, Black & Veatch
Session Chair: Hamed Mohsenian-Rad, University of California at Riverside

Communications and networking technologies are essential in modern power systems to facilitate access to new and diverse data types and to support new and enhanced functions such as distribution system automation, demand response, dynamic pricing, resilience and self-healing operation, and integration of renewable energy resources. As a collaborative effort between the IEEE Power and Energy Society and the IEEE Communications Society, this panel will seek to identify the industry requirements, research priorities, open problems, and emerging applications of communications and networking technologies in power and energy systems. Communications architectures and protocols as well as communication-centric data-management solutions will be discussed with applications at transmission, distribution, and utility-scale microgrid settings. This
Panel will bring together utility and power industry experts, application
developers, and academic researchers.

Research Priorities and Open Problems in Power Systems Communications and
Networking
Speaker: Hamed Mohsenian-Rad
Affiliation: University of California at Riverside

TBA
Speaker: Rajit Gadh
Affiliation: UCLA

TBA
Speaker: Andrea Tonello
Affiliation: Institute of Networked and Embedded Systems

Modern Substation Automation System: Current status & Potential areas of
development
Speaker: Deepak Maragal
Affiliation: NYPA

Impact of the new Power System Communications and Cybersecurity Commitee
on Solving Open Problems and Identifying Research Priorities in Power
System Communications and Networking
Speaker: Craig Preuss
Affiliation: Black & Veatch

Domain-Specific Big Data Analytics Tools in Power Systems
Sponsoring Committee: Substations

Session Chair: Hamed Mohsenian-Rad, University of California at Riverside

The increasing penetration of sensing and communications capabilities in
power systems, and the growing use of smart meters, phasor measurement
units, and other monitoring devices, has introduced a tremendous growth
in the amount and diversity of data that is collected in the power
industry. Accordingly, there is a growing interest in employing big data
analytics to examine diverse data sets of large volumes to uncover
unknown correlations other useful business information. While the
applications of big data analytics in power systems have recently
attracted many researchers, the methodological aspects are still
unexplored. That is, it is still unclear whether, why, and how we may
need to develop new and domain-specific tools to conduct big data
analytics specifically in power systems. This panel will identify the
industry needs and research priorities for developing such new tools as
well as the current state-of-the-art in both industry and academia.

TBA
Speaker: Chuanyi Ji
Affiliation: Georgia Institute of Technology
Domain-Specific Big Data Analytics Tools in Power Systems
Speaker: Hamed Mohsenian-Rad
Affiliation: University of California at Riverside

TBA
Speaker: Zhenyu Huang
Affiliation: PNNL

Space Weather and the Power Grid: when two worlds collide!
Sponsoring Committee: Local Organizing Committee

Session Chair: Philip Erickson, Massachusetts Institute of Technology

[NOTE: this will be an evening session which will complement the MIT Haystack Observatory tour - planned for Wednesday evening following the tour, but open to all GM attendees]
Abstract: This presentation will first introduce Earth’s space environment, encompassing the lower and upper atmosphere and containing charged, magnetized plasma. Space weather, the study of variations in this environment, has become a major national research focus over the last several decades. We will show examples of steady progress in modern space and ground based observations and modeling of effects. Second, we will focus on space weather effects on power grid systems and in particular the phenomenon of geomagnetically induced currents (GICs), along with direct GIC effects on power transmission equipment. GICs are a recent national priority as highlighted in US White House Office of Science and Technology Policy (OSTP). Comparisons of historical GIC events will be followed by discussion of present day concerns for today’s grid. Finally, we will provide some ideas on combining scientific research and operational needs to increase national resilience and preparation for inevitable space weather events.

Space Weather and the Power Grid: when two worlds collide!
Speaker: Philip Erickson
Affiliation: Massachusetts Institute of Technology

Space Weather and the Power Grid: when two worlds collide!
Speaker: Wayne Hagman
Affiliation: Eversource Energy

Challenges/Issues for Smart Grid
Sponsoring Committee: Power System Instrumentation and Measurements

Session Chair: Alexander Emanuel, WPI-USA/Federal University of Uberlandia - Brazil

Session Chair: Eddy So, NRC

This panel will cover measurement challenges and issues related the power electronics and sensors on the smart grid.
Power Electronics: Roles in Renewable Energy Generation - Challenges and Opportunities
Speaker: Eduard Muljadi
Affiliation: NREL

Measurement System Challenges for the Smart Grid
Speaker: Harold Kirkham
Affiliation: Pacific Northwest National Laboratory

Advanced Applications of AMR Data for Enhancing Smart Grid Operation
Speaker: Sioe Mak
Affiliation: ESTA International

AMI implementation in China
Speaker: Peng Wang
Affiliation: EPRI China

Building Information Modelling For Smart (Gridable) Environments: Challenges and Issues
Speaker: Tek Lie
Affiliation: Auckland Technical University

Challenges to update IEEE Std. 1459 - 2010 to address issues in Smart Grid
Speaker: Alexander Emanuel
Affiliation: WPI-USA/Federal University of Uberlandia - Brazil
Panelist: Alexander Emanuel, Jose-Rubens Macedo Jr.

(1) Non-intrusive Load and Asset Monitoring Technologies and Practices
Sponsoring Committee: Power System Instrumentation and Measurements

Session Chair: Eddy So, NRC
Session Chair: Wenpeng Luan, EPRI

Load and Access Online Monitoring Technologies and Practices on the Power System

To be held in conjunction with WG on Sensors

Non-Intrusive Load Monitoring - Methods and Applications
Speaker: Chris Holmes
Affiliation: EPRI

DecorTic: a method for detecting and estimating the consumption of electrical space heating in residential housing
Speaker: Bruno Charbonnier
Affiliation: EDF

Dynamic Line Ratings: A Tool for Transmission Asset Management
Speaker: Keith Lindsey
Affiliation: Lindsey Manufacturing, Co.

Power Transformer Monitoring using High Frequency Transients for Asset Condition Assessment
Speaker: Jim McBride
Affiliation: JMX Services, Inc.

Construct Energy Big Data Using Non-intrusive Load monitoring technology
Speaker: Wenpeng Luan
Affiliation: EPRI