April 25, 2022 (Monday)

Aligning Smart Grid Operational Monitoring and Regulatory Data Requirements on Decarbonization (panel session)
Location - Room 391-392
Monday, April 25, 2022 11:00 AM-12:30 PM
Session Chair: Shawn Chandler, IEEE, and Jeff Richman, Cognizant

The electric grid is a complex system with highly differentiated energy supply management, regulatory, and grid operational domains. Emerging digitalization technologies such as digital twin, simulation and distributed ledgers (Blockchain) are set forth with broad goals as a foundation to support decarbonization and align the distributed nature of operations across each grid domain. This session will explore perspectives on the technologies, architectures, use cases, and standards evolving to advance smart grid treatment of EV adoption and electrified transportation. The panel session will focus on key system features and challenges within industry, ISO and utility operations, accommodating two industrial, one utility and one ISO sub-topic:

- ISO perspective on DLT, tracking decarbonization and market implementation
- Utility applications for supporting decarbonization through EV program design and regulatory
- alignment
- Contrasting European carbon market emissions tracking with North American EV and smart grid
- Use of digital twin and DLT as a mechanism for gathering regulatory data on EV and EVSE
- program management

Presentations and Panelists:

- "Utility Applications for Supporting Decarbonization through EV Program Design and Regulatory Alignment" by D. Jones, Guidehouse, Inc.
- "ISO Perspective on DLT - Tracking Decarbonization and Market Implementation" by S. Zulkader, CAISO
- "Contrasting European Carbon Market Emissions Tracking with North American EV and Smart Grid Opportunities" by P. Van Knijff, The Future of Trust
- "Use of Digital Twin and DLT as a mechanism for EV and EVSE Utility Program Management" by S. Chandler, IEEE

Evolutionary Grid Communication Planning and Applications in 5G Era and Future (panel session)
Location – Room 386
Monday, April 25, 2022 11:00 AM-12:30 PM
Session Chair: Xiaoyuan Fan, Pacific Northwest National Laboratory

Power Grid is one of the most complex distributed engineering systems, which not only encompasses numerous power system assets for generation, transmission, and distribution, but also requires dynamic, sustainable, reliable, and resilient operation in support of uninterrupted social and economic development. The undergoing generation mix shift to high renewable penetration future and the deepening interdependence between power system and communication networks, calls upon national-wide energy stakeholders to collaboratively explore and integrate advanced communication technology (i.e., 5G in deployment phase and 6G on the research horizon).
The 5G performance is critical to bridge the unparallel volume of data from sensors that are embedded in power system equipment and devices found in our homes, buildings, factories, communities, and high-density urban areas. Through a holistic and coordinated evolutionary grid communication planning and pilot use case development, those advanced grid sensors spanning transmission, distribution, distributed resources, and behind-the-meter assets, could provide accurate yet real-time information for grid asset monitoring and control, and collectively provide the best situational awareness to grid operators. Availability of this diverse

data from multiple sources also support more efficient use of non-utility energy resources for homes, buildings, campus, transportation, and other participants in a clean-energy economy.

Presentations and Panelists:

- "Future Communication Technologies for Smart Grid and Control Applications" by W. Saad, Virginia Tech
- "Coordinated Grid Communication Planning" by J. Ogle, PNNL
- "5G Smart Grid Applications, Challenges, and Opportunities" by M. Subieta, Nokia
- "Cyber-Physically Resilient Situational Awareness of Power Grids" by Y. Lin, University of Massachusetts Lowell

Managing High Penetration DERs with Integrated System Modeling (panel session)
Location – Room 398 - 399
Monday, April 25, 2022 11:00 AM-12:30 PM
Session Chair: Weston Dengler, SEPA

Learn how a digital twin can you help you integrated DERs into your network. With modeling and simulation of a combined grid network including transmission and distribution, greater situational awareness is achieved to help you in ensuring reliability and control. You will learn how anomalies are detected as well as inverter behavior when there is a high concentration on a feeder.

Presentations and Panelists:

- "Faster than Realtime Simulation: Preparing for DERs" (focus on business value for integrated simulation/planning) by L. Watson, Pepco Holdings
- "Faster than Realtime Simulation: Preparing for DERs" (focus on modeling of transmission/distribution and detection of anomalies) by R. Broadwater, EDD
- "Faster than Realtime Simulation: Preparing for DERs" (focus on use of irradiance data for operational use) by A. Saunders, Clean Power Research
- "Faster than Realtime Simulation: Preparing for DERs" (focus on testing with field and hardware in the loop) by R. Broadwater on behalf of S. Hegedus, Univ of Delaware

Human-Machine Teaming and Operational Considerations for New Smart Grid Technologies (panel session)
Location – Room 391-392
Monday, April 25, 2022 1:30 PM-3:00 PM
Session Chair: Alexander Anderson, PNNL

A new generation of advanced power applications (within the EMS, DMS, and DERMS sectors) will be needed to ensure reliable, resilient, robust, safe, and economic operations. However, for new applications and smart grid technologies to be adopted by utilities, developers need to consider not only the technical aspects, but a wide range of operational considerations and whether new systems are usable by power system operators. Barriers to industry adoption and deployment in control room applications include:

- Technology readiness level vs human readiness level - While new technologies are developed explicitly with the TRL scale in mind, the human readiness level of the technology is often neglected. Measuring when a technology is ready for end users is a major part of the evaluation process for deploying new technologies.
- Operational considerations – Utility engineers and operators will likely reject any new technologies that do not consider line crew safety, existing operational procedures, work clearances, customer acceptability, workforce rules, data management, and integration with other utility systems.

- Human machine trust – Related to but beyond technology performance, operators need to trust the results of the technology and know when to (and when not to) use new technologies. In high stakes environments, like control rooms, there little room for error, from machine accuracy to operator use.
- Situational awareness - In control environments, maintaining high awareness of grid performance is critical. Many technologies in the control room require operator attention and engagement to be effective. The challenge is that with many indicators providing false alarms, the demand on operator attention negatively impacts situational awareness of the grid. When new technologies add relatively little benefit when compared to additional tasking, these technologies are often rejected.

The discussion will focus on approaches to validating and verifying new technologies, as well as accelerating adoption for control room use, including

- Elicitation of power system operator workflows
- Integrating new technologies with current operational practices
- Use of real-time simulation and virtual control room demonstrations
- Realistic operational scenarios to validate technology and human readiness levels

Presentations and Panelists:

- "Human-Machine Teaming for AI/ML Tools" by B. Jefferson, PNNL
- "Control Room Evaluation of ADMS Apps" by J. Barr, PNNL
- "Operational Considerations for Smart Grid Tech" by J. Gibson, Avista Utilities
- "Pathways to Industry Adoption" by S. Vadari, Modern Grid Solutions

Blockchain in Energy as a Venue for Electricity Grid Modernization (panel session)

Location – Room 386

Monday, April 25, 2022 1:30 PM-3:00 PM

Session Chair: Umit Cali, Norwegian University of Science and Technology, and Claudio Lima, Blockchain Engineering Council, BEC

As one of the emerging digitalization technologies Blockchain Technology helps to decarbonize and democratize the power grid by creating additional use cases and markets for the solar power dominated Peer to Peer energy trading (P2P energy trading). Even though the most popular Blockchain in Energy related use cases are clustered around P2P energy trading, other promising energy use cases and implementations are also eligible for the Blockchain technology in power domain. This workshop will give an overview of the key technologies, use cases, initiatives, recent advances, task forces and standards being developed by the IEEE, industry, academia, and policy makers to advance the emerging field of Blockchain in Transactive Energy, focused on electric power and power grid modernization. Workshop topics include, among others, blockchain-based transactive energy systems, utility blockchain applications, interoperability, blockchain for enhanced cybersecurity, field implementations: industrial,academic, markets and policy practices. This panel accommodate three industrial and one academic sub-topic:

- Cybersecurity aspects of DLT-enabled transactive energy system,
- Interoperability aspects of DLT-enabled transactive energy systems,
- Blockchain enabled transactive energy systems and their use cases,
- Recent Advances in IEEE Blockchain Enabled Transactive Energy Initiative
- Use of blockchain to facilitate data sharing and/or detecting and isolating of untrusted devices in a smart grid.

This panel session is designed as a joint and collaborative event between P2418.5 - Standard for Blockchain in Energy and IEEE Technology and Engineering Management Society (TEMS)'s Technical Committee (TC) on Blockchain and Distributed Ledger Technologies (DLT).

Presentations and Panelists:

- "Cybersecurity aspects of DLT-enabled transactive energy systems" by S. N. Gupta Gourisetti, Pacific Northwest National Laboratory

- "Interoperation of DLT-enabled transactive energy systems" by S. Chandler, GridCure, Inc.
- "Near Term Non-peer to Peer Opportunities for BCTE" by J. Kempf, Kempf and Associates Consulting
- "Recent Advances in IEEE Blockchain Enabled Transactive Energy Initiative" by F. Rahimi, OATI
- "Use of blockchain to facilitate data sharing and/or detecting and isolating of untrusted devices in a smart grid" by K-K R. Choo, The University of Texas at San Antonio

DER Communication Standards, Architecture and Interoperability (panel session)
Location – Room 398 - 399
Monday, April 25, 2022 1:30 PM-3:00 PM
Session Chair: James Mater, QualityLogic, Inc

As the Electric Sector starts to address the challenges of how to transform the grid to accommodate rapid increases in distributed resources and flexible loads, the key to successful scaling is a standardized communications infrastructure. Standardization enables faster, lower-cost integration of renewable and flexible loads. But the choice of communications architecture and the specific standards has a significant impact on the interoperability of the resulting infrastructure and subsequent success. This panel session will explore the three intertwined topics: architectural considerations and models for DER/Flexible Load integration; choosing communications standards and the interoperability challenges and solutions when creating a standardized infrastructure.

Presentations and Panelists:
- TBD by Aaron Smallwood, SEPA
- TBD by Jaime Kolln, PNNL
- TBD by Dhananjay (DJ) Anand

Grid Planning and Operation Technologies, Effectiveness and Costs for High DER Integration and Adoption (plenary panel session)
Location – Room 391-392
Monday, April 25, 2022 3:30 PM-5:00 PM
Session Chair: Julieta Giraldez, Kevala

New customer-sited technologies and distributed energy resources are changing the way the grid is planned and operated, in particular at the distribution system level. The distribution grid is no longer a passive system, but an active and dynamic two-way power-flow system. As such, awareness of what is happening at the grid-edge is now crucial to inform planning and real-time operation of the grid. The panelists and session chair have several ongoing collaborations that focus on understanding the platforms and systems that can support grid decarbonization with high DER and transportation electrification adoption.

The panelists will present findings of the following projects:
- DOE Solar Office funded project in which Kevala's data platform is supporting NREL's modeling of the grid edge to improve the interconnection of DER, and EPRI is a member of the project's Advisory Board Group.
- DOE Solar Office funded project in which NREL and Sandia, along with other project partners are providing lessons learned on the effectiveness and techno-economic evaluation of grid integration strategies such as DERMS, Volt-Var Optimization (VVO), and smart inverters in increasing hosting capacity; EPRI is also a member of the project's Advisory Board Group.
- NYSERDA funded project in which Utilidata and NREL, along with National Grid and Standard Solar, are collaborating to evaluate how real-time control platforms, including VVO, interact with smart inverters and smart meters to decrease energy consumption, increase DER hosting capacity, and impact solar developer business models.

The panelists proposed have an ample vision of the technologies, processes and requirements that the different stakeholders involved in achieving a full grid decarbonization process require. They are also actively involved in achieving such goals with regulators, utilities and DER developers in different states across the US. As such, we plan to discuss not only the technical requirements of platforms and systems required for high DER adoption, but also the importance of evaluating costs and benefits to achieve a decarbonized grid. The panelists will share a roadmap of where we are now in terms of implementation and deployment, and the vision on the future technological developments in the next 5 to 10 years.

Presentations and Panelists:

- "Real-Time Control Platform for a High DER Future" by M. Hummon, Utilidata
- "Grid Planning for High DER and Transportation Electrification Future" by A. Shumavon, Kevala
- "Modelling and Analysis with High Penetration PV, Including Advanced Software Tools" by M. Reno, Sandia National Labs
- "Modeling and Operation Impacts of Battery Storage as DER" by J. Peppanen, EPRI

"Distribution Planning with Customer-Sited Resources" by J. Keen, NREL

April 26, 2022 (Tuesday)

Offshore Wind Integration: DOE Perspectives and European Lessons Learned and Best Experiences (panel session)
Location – Room 391 -392
Tuesday, April 26, 2022 1:00 PM-2:30 PM
Session Chair: Lina He, University of Illinois Chicago

To accelerate grid decarbonization, many countries have issued strong incentives to significantly increase the installation of renewable energy resources, including offshore wind. The United States (U.S.) government has set an ambitious target to install offshore wind generators of 30 gigawatts (GW) by 2030. It is shown in existing studies that voltage source converter-based high voltage direct current (VSC-HVDC) is considered as the most effective solution for large-scale, long-distance offshore wind power transmission due to its advantages of fast and independent control of active and reactive power, feasibility of multi-terminal dc grids, and black start capability. The rapid growth of offshore wind power can significantly impact the stability and resilience of onshore ac grids. This poses great challenges to the modeling, control, protection, operation, and security of VSC-HVDC connected offshore wind generators. This panel will share DOE perspectives on offshore wind integration and European lessons learned and best experiences to provide good guidance to speed up the development of U.S. offshore wind technologies.

Presentations and Panelists:

- "Offshore wind transmission: the challenges and opportunities" by J. Fu, DOE EERE WETO
- "Challenges and Solutions of Offshore Wind Integration" by L. He, University of Illinois Chicago
- "Dynamic Performance of Offshore connections with HVDC in the AC grid" by E. Starschich, Siemens Energy
- "Offshore in France and Europe, a TSO perspective" by T. Prevost, RTE

Grid Technologies Driving Responses to Climate Change (panel session)
Location – Room 386
Tuesday, April 26, 2022 1:00 PM-2:30 PM
Session Chair: Ahad Esmaeilian, Avangrid and Daniel Kushner, Accenture

This panel looks at how advanced grid technologies, from DERMS to microgrids to HVDC, are enabling clean energy resources that are helping to mitigate and adapt to climate change. It will talk about case studies

of how such solutions have been deployed in the past, emerging best practices, and future directions to accomplish the clean energy transition.

Panelists:

- "Grid Modernization to Mitigate Impacts from and Adapt to Climate Change" by A. Paaso, Quanta Technology
- "Technologies to Advance DER Integration and Management at the Grid Edge" by C. Zhang, Eaton
- "Medium Voltage Power Electronics Enabling DER and Increasing Climate Resiliency" by B. Mather, NREL
- "Line Monitoring Technologies for Increased Renewables Integration and Grid Resilience" by H. Gilmer, LineVision

Leveraging High-fidelity Cyber Physical Testbeds & Datasets for Prototyping and Validating Resilient Controls for Future Grids (panel session)
Location – Room 398 - 399
Tuesday, April 26, 2022 1:00 PM-2:30 PM
Session Chair: Aditya Ashok, PNNL

As the penetration of distributed energy resources (DERs) continues to increase across the entire transmission and distribution grid, it is extremely important to ensure that their associated hierarchical controls at different levels (device, sub-system, system level) work together to enhance the overall stability, reliability, and resiliency of the system. Under this context, it is essential to ensure that existing simulation models accurately capture the behavior of futuristic smart grids under a range of normal and off-normal conditions including natural faults and cyber attacks. Cyber Physical Testbeds serve as an ideal platform to ensure that high-fidelity, real-time models can be interfaced with real/emulated controllers and actual hardware subsystems to perform controller/power hardware in the loop experimentation across a range of conditions. This would enable the validation of these component and system models across a range of conditions and allows the impact assessment of various types of hazards on the controls and the evaluate the overall resilience of the system. Further, these testbeds allow the generation of much needed datasets, which can drive the development and testing of new data-driven, resilient controls for DERs.

In this panel, we intend to bring together a panel of subject matter experts across the national labs and universities with well-known cyber physical system testbeds. Each of the panelists will talk about their unique perspectives on leveraging such testbeds to perform relevant research to implement, prototype, and validate resilient controls, as well as on available resources such as models and datasets for the research community. Overall, we anticipate our panel to provide a synthesis of valuable technical information on how cyber physical testbeds provide value to prototype and validate resilient controls for futuristic grids with a lot of DERs.

Presentations and Panelists:

- "Combining multiple levels of fidelity for experimentally investigating proof of concept controls and quantifying resilience" by T. Edgar, Pacific Northwest National Laboratory
- "High-Fidelity, Scalable CPS Security Testbeds for Smart Grid and Its R&D use-cases" by M. Govindarasu, Iowa State University
- "Experiences of configuring Duke Energy Smart Grid Laboratory testbed and using it on research projects" by R. Cox, University of North Carolina, Charlotte
- "Practical design considerations for commercial microgrids and field deployment experiences for developing realistic testbeds" by S. Cherian, Spirae, LLC

April 27, 2022 (Wednesday)

Regulatory Challenges in Deployment of Transmission Grid-Enhancing Technologies (panel session)
Location – Room 391-392
Wednesday, April 27, 2022 1:00 PM-2:30 PM
Session Chair: Kaveh Aflaki, Smart Wires Inc.

Panelists from the regulatory section of the energy industry will focus on regulatory challenges for the deployment of transmission technologies across the US regions. As deployed in certain circumstances, the enhanced transmission technologies would enhance reliability, efficiency, and capacity and improve the operation of new or existing transmission facilities. This panel will discuss regulatory challenges in implementing this shared savings incentive approach for transmission technologies under Federal Power Act section 219. In addition, this panel will look into FERC orders and workshops with a focus on how to calculate ex-ante and ex-post benefit analysis for Grid-Enhancing Technologies (GETs) including but not limited to (i) Dynamic Line Rating (DLR), (ii) advanced modular power flow control (MPFC), (iii) and grid topology optimization.

Presentations and Panelists:
- "Regulatory Challenges in Deployment of Transmission Grid-Enhancing Technologies" (Discussion) by K. Harriman, AVANGRID
- "Regulatory Challenges in Deployment of Transmission Grid-Enhancing Technologies" (Discussion) by N. Brownell, Former FERC Commissioner
- "Regulatory Challenges in Deployment of Transmission Grid-Enhancing Technologies" (Discussion) by J. Dennis, Advanced Energy Economy (AEE)
- "Regulatory Challenges in Deployment of Transmission Grid-Enhancing Technologies" (Discussion) by R. Gramlich, Grid Strategies

Artificial Intelligence and Digital Twin Technologies for Smart Grid Applications (panel session)
Location: Room 386
Wednesday, April 27, 2022 1:00 PM-2:30 PM
Session Chair: Shishir Shekhar, Itron Inc
Session Co-Chair: Steffen Ziegler, IMCORP USA

The use of AI and Digital Twin techniques is growing in popularity across the electric utilities sector for asset management, demand response, energy storage, renewable resources, E-Mobility, and many other areas. The Gartner report said, "Four years ago, AI implementation was rare, only 10% of survey respondents reported that their enterprises had deployed AI or would do so shortly. For 2019, that number has leapt to 37% — a 270% increase in four years." This panel will bring together industry experts from different backgrounds (R&D, Manufacturers, Utilities Academia, and Solution Providers) to discuss various aspects of Big Data, Digital Twins, Machine Learning, and Artificial Intelligence technologies for developing Forecasting, E-Mobility, Energy Management, and Asset Management Solutions. Topics include:
- Machine Learning and Deep Learning technologies for Real-Time Asset Condition Monitoring AND Predictive Maintenance.
- Machine Learning technologies for Forecasting Application (Energy and Weather Forecasting)
- Virtual Power Plants (VPP) using AI
- E-Mobility and EV Integration

Presentations and Panelists:
- "Accelerating the adoption of EVs by managing assets at the Grid Edge" by M. Braby, Itron Inc
- "Predictive Asset Life Cycle Management of Underground Cable Systems based on Characterization of Partial Discharge" by S. Ziegler, IMCORP Inc

- "Microgrid Resilience Framework based on Real-time Digital Twins and Hardware-In-the-Loop" by M. Mohanpurkar, NREL USA
- "Power resilience in a changing climate and increased penetration of energy renewables" by M. Peña, Eversource Energy Center
- "Optimizing EV Fleets with Smart Charging Management for Grid Resiliency" by N. Sankar, Microgrid Labs LLC

Provision of Grid services from Grid-Edge Assets (panel session)
Location – Room 398 - 399
Wednesday, April 27, 2022 1:00 PM-2:30 PM
Session Chair: Farrokh Albuyeh and Farrokh Rahimi, OATI

The electricity market in undergoing fundamental changes due to proliferation of variable energy resources (VERs) at bulk and Distributed Energy Resources (DERs) at the grid edge. These changes are leading to the need for increasing levels of conventional grid services such as operating reserves and frequency regulation as well as the need for new types of grid services. The latter include ramping, load following, and Fast Frequency Response to mention a few. There is also increasing need for distribution grid services such as voltage regulation, phase balancing, and reverse flow mitigation. This panel session will address how DERs can be leveraged to turn them from being a problem for grid operation into a solution for provision of grid services. The following topics will be addressed:

- Impact of VERs and DERs on power grid and energy market operations
- Conventional and emerging grid services
- Possibilities and limitations of providing grid services from DERs
- Systems and platforms for DER participation in provision of grid services
- Implementation examples and field results

Panelists:
Presentations and Panelists:

- "Systems and Platforms for DER Participation in Provision of Grid Services" by A. Ipakchi, OATI
- "Bulk Renewable and BTM PV and EV Integration – Adding Value and Mitigating Impacts" by A. James, SCE
- "DER-Enabled ADMS" by S. Borlase, ESTA International, LLC

Distribution Markets and Platforms for Integration of Distributed Energy Resource (plenary panel session)
Location – Room 391 - 392
Wednesday, April 27, 2022 3:00 PM-4:30 PM
Session Chair: Farrokh Rahimi, OATI

The electricity industry mostly perceives Distributed Energy Resources (DERs) as a problem because they don't fit nicely into existing markets, operating paradigms and revenue models. This perception is invalid in the emerging participatory grid because in fact DERs are an essential part of the solution to decarbonization, resilience and environmental justice. This panel session explores the possibilities and limitations of local energy markets for DER integration into grid operation, power markets and new business models. The panelists will cover the following topics:

- Impacts of increasing levels of DER on current grid operations and utility business models
- Emerging market actors and energy market dynamics
- Incentive compatibility considerations to align DER investment and operating incentives with grid reliability and larger societal objectives
- Platform functionality for distribution-level markets
- Current industry activities, lessons learned, and path forward

Presentations and Panelists:

- "Operational and business model impacts of DER Proliferation" by A. Ipakchi, OATI
- "Distribution-level markets to maximize DER benefits" by L. Kristov, Electric System Policy
- "Peer-to-Peer Transaction of Energy and Carbon Allowance in Networked Microgrids" by M. Shahidehpour, IIT
- "Distribution System Platforms for DER Management" by A. Renjit, EPRI
- "Engaging Non-Utility PVs for Grid Services" by B. Bhattarai, DOE/SETO

ISGT Poster Session (poster session)
Location - La Nouvelle Orleans Ballroom
Wednesday, April 27, 2022 5:00 PM-7:00 PM
Session Chair: Masood Parvania, The University of Utah

* 22ISGT0004, Harmonic Modeling, Data Generation, and Analysis of Power Electronics-Interfaced Residential Loads
A. SINGHAL, Pacific Northwest National Laboratory
D. WANG, Pacific Northwest National Laboratory
A. REIMAN, Pacific Northwest National Laboratory
Y. LIU, Pacific Northwest National Laboratory
D. HAMMERSTROM, Pacific Northwest National Laboratory
S. KUNDU, Pacific Northwest National Laboratory

* 22ISGT0010, Analyzing Accuracy of Inverse Power Flow from Noisy Edge Measurements
C. MORGENSTERN, Arizona State University
J. MORGENSTERN, University of Washington
R. YANG, National Renewable Energy Lab
E. COOK, Duquesne Light Company

* 22ISGT0013, Faulty Feeder Identification Technology utilizing Grid-Connected Converters for Reduced Outage Zone in Smart Grids
H. GOYAL, Hitachi Ltd.
A. KIKUCHI, Hitachi Ltd.

* 22ISGT0015, Power System Event Identification with Transfer Learning Using Large-scale Real-world Synchrophasor Data in the United States
J. SHI, University of California, Riverside
K. YAMASHITA, University of California, Riverside
N. YU, University of California, Riverside

* 22ISGT0019, Analysis of STATCOM Oscillations using Ambient Synchrophasor Data in Dominion Energy
C. MISHRA, Dominion Energy
L. VANFRETTI, Rensselaer Polytechnic Institute
D. YANG, Dominion Energy
C. WANG, Dominion Energy
X. XU, Dominion Energy
K. D. JONES, Dominion Energy
R. M. GARDNER, Dominion Energy

* 22ISGT0021, A Reward Mechanism for Reliability-as-a-Service Usage of Electric Vehicles
A. HUSSAIN, University of Alberta
P. MUSILEK, University of Alberta

* 22ISGT0023, Data-Driven Generic Turbines for Distributed Wind Modeling, Optimization, and Economic Studies
A. REIMAN, Pacific Northwest National Laboratory
T. RAMACHANDRAN, Pacific Northwest National Laboratory
A. ORRELL, Pacific Northwest National Laboratory

* 22ISGT0025, Input Signal for Synthetic Inertia: Estimated ROCOF Versus Remote Machine Acceleration
F. WILCHES-BERNAL, Sandia National Labs
J. WOLD, Montana Technological University
W. H. BALLIET, Sandia National Labs

* 22ISGT0028, Smart Sensors for Insulation System Condition Monitoring: Focus on Partial Discharges and Space Charge
G. C. MONTANARI, Florida State University
R. GHOSH, University of Bologna
A. KOHLI, Rugged Monitoring
R. KARANAM, Rugged Monitoring

* 22ISGT0029, An End to End Data Collection Architecture for IoT Devices in Smart Cities
M. KUZLU, Old Dominion University
H. KALKAVAN, Old Dominion University
O. GUELER, eKare, Inc.
N. ZOHRABI, Pennsylvania State University
P. J. MARTIN, Virginia Commonwealth University
S. ABDELWAHED, Virginia Commonwealth University

* 22ISGT0030, Multiagent Power Transaction in Multiarea System with Decentralized Metaheuristic Frameworks
L. CANHA, Federal University of Santa Maria
O. ADEYANJU, Federal University of Santa Maria

* 22ISGT0031, A Data-Driven Democratized Control Architecture for Regional Transmission Operators
X. FAN, Pacific Northwest National Laboratory
D. MOSCOVITZ, PJM Interconnection
L. DU, Temple University
W. SAAD, Virginia Polytechnic Institute and State University

* 22ISGT0032, Development and Implementation of a Holistic Flexibility Market Architecture
O. KRAFT, TU Dortmund University
O. POHL, TU Dortmund University
U. HÃ„GER, TU Dortmund University
K. HEUSSEN, Technical University of Denmark
N. MÃœLLER, Technical University of Denmark
Z. AFZAL, KTH Royal Institute of Technology
M. EKSTEDT, KTH Royal Institute of Technology
H. FARAHMAND, Norwegian University of Science and Technology
D. IVANKO, Norwegian University of Science and Technology
A. SINGH, Electrical Energy Division, PSI Software AG
S. LEKSAWAT, Electrical Energy Division, PSI Software AG
A. KUBIS, Electrical Energy Division, PSI Software AG

* 22ISGT0033, Evaluation Method of Spatio-Temporal Flexibility as Renewable Energy Absorption Potential of a Group of Electric Buses Using Bus Operation Data
Y. TOMIZAWA, Waseda University
Y. IHARA, Waseda University
Y. KODAMA, Waseda University
Y. IINO, Waseda University

Y. HAYASHI, Waseda University
O. IKEDA, TEPCO Power Grid, Inc.
J. YOSHINAGA, TEPCO Power Grid, Inc.

* 22ISGT0035, Power Management via Integration of Battery Energy Storage Systems with Electric Bus Charging
S. N. GOWDA, University of California Los Angeles
A. AHMADIAN, University of California Los Angeles
V. ANANTHARAMAN, University of California Los Angeles
C-C CHU, University of California Los Angeles
R. GADH, University of California Los Angeles

* 22ISGT0036, Fast Oscillation Detection and Labeling via Coarse Grained Time Series Data for ML Applications
X. XU, Dominion Energy
C. MISHRA, Dominion Energy
L. VANFRETTI, Rensselaer Polytechnic Institute
C. WANG, Dominion Energy
K. JONES, Dominion Energy
R. M. GARDNER, Dominion Energy
S. MURPHY, PingThings, Inc.

* 22ISGT0038, Reachability Analysis for Controlling DERs to Mitigate Disturbances in Distribution Grids
J. SWARTZ, University of California - Berkeley
A. VON MEIER, University of California – Berkeley

* 22ISGT0039, KEF: A Key Exchange Framework for Operational Technology Security Standards and Guidelines
A. S. SANI, University of Greenwich
D. YUAN, The University of Sydney
K. MENG, University of New South Wales
Z. Y. DONG, University of New South Wales

* 22ISGT0040, Determining an Operation Sequence for Proactive Islanding of the Power Grid
S. BISWAS, Virginia Tech
V. CENTENO, Virginia Tech

* 22ISGT0043, Proactive Posturing of Large Power Grid for Mitigating Hurricane Impacts
E. A. QUARM JNR, Pacific Northwest National Laboratory
X. FAN, Pacific Northwest National Laboratory
M. ELIZONDO, Pacific Northwest National Laboratory
R. MADANI, University of Texas at Arlington

* 22ISGT0044, Valuation of Behind-the-Meter Energy Storage in Hybrid Energy Systems
R. TREVIZAN, Sandia National Laboratories
A. HEADLEY, The University of Memphis
T. NGUYEN, Sandia National Laboratories
S. ATCITTY, Sandia National Laboratories

* 22ISGT0045, Sparse Time Series Sampling for Recovery of Behind-the-Meter Inverter Control Models
S. TALKINGTON, Georgia Institute of Technology
S. GRIJALVA, Georgia Institute of Technology
M. J. RENO, Sandia National Laboratories

* 22ISGT0046, Dissipativity-based Voltage Control in Distribution Grids
K. KOSARAJU, Notre Dame University
R. TREVIZAN, Sandia National Laboratories
L. YE, Notre Dame University
V. GUPTA, Notre Dame University

B. CHALAMALA, Sandia National Laboratories
R. BYRNE, Sandia National Laboratories

* 22ISGT0047, DERMS Online: A New Voltage Sensitivity-Enabled Feedback Optimization Framework
Y. YAO, National Renewable Energy Laboratory
K. YE, Mississippi State University
J. ZHAO, Mississippi State University
F. DING, National Renewable Energy Laboratory
J. GIRALDEZ, National Renewable Energy Laboratory

* 22ISGT0049, An Algorithm for Fast Fault Location and Classification Based on Mathematical Morphology and Machine Learning
F. WILCHES-BERNAL, Sandia National Labs
M. JIMÉNEZ-APARICIO, Sandia National Labs
M. RENO, Sandia National Labs

* 22ISGT0050, Chance Constrained Distributionally Robust Optimal HVAC Scheduling for Commercial Building Demand Response
G. TIAN, University of Central Florida
Q. SUN, University of Central Florida

* 22ISGT0052, Integrating Geospatial Data for Weather Station Selection and Enhanced Electric Load Forecasting10.2.0
D. DONALDSON, University of Birmingham
D. JAYAWEERA, University of Birmingham

* 22ISGT0055, Privacy-Enhancing Settlements Protocol in Peer-to-Peer Energy Trading Markets
R. THANDI, The University of Manchester
M. MUSTAFA, The University of Manchester

* 22ISGT0056, Dynamics-aware Optimal Operation of Microgrids in Islanded Mode
R. KHATAMI, The University of British Columbia
B. CHEN, The University of British Columbia
Y. C. CHEN, The University of British Columbia

* 22ISGT0057, NILM-Synth: Synthetic Dataset Generation for Non-Intrusive Load Monitoring Algorithms
J. DONNAL, US Naval Academy

* 22ISGT0058, Line Outage Identification using Limited PMUs with Partial Knowledge on Area of Disturbance
K. MAHAPATRA, Pacific Northwest National Laboratory
Q. HUANG, Pacific Northwest National Laboratory

* 22ISGT0059, Decentralized Coordinated State Estimation in Integrated Transmission and Distribution Systems
Y. ZHANG, Brookhaven National Laboratory
Y. CHEN, North China Electric Power University
J. WANG, Southern Methodist University
M. YUE , Brookhaven National Laboratory
T. ZHAO, Brookhaven National Laboratory

* 22ISGT0061, An End-to-End Cyber-Physical Infrastructure for Smart Grid Control and Monitoring
A. DEY, University of Minnesota Twin Cities
S. CHAKRABORTY, University of Minnesota Twin Cities
M. V. SALAPAKA, University of Minnesota Twin Cities

* 22ISGT0062, Unsupervised Identification of Electrical Loads from Aggregate Power Measurements
N. JAWDAT, Independent Researcher

J. DONNAL, US Naval Academy

* 22ISGT0063, A Novel Continuum Approximation to Power System Electromechanical Dynamics
S. LEI, Illinois Institute of Technology
D. MALDONADO, Argonne National Laboratory
E. CONSTANTINESCU, Argonne National Laboratory
J. ZHAO, Mississippi State University
S. YARAHMADI, Virginia Tech
L. MILI, Virginia Tech
M. ANITESCU, Argonne National Laboratory

* 22ISGT0066, Hierarchical Transactive Control of Flexible Building Loads Under Distribution LMP
B. PARK, Oak Ridge National Laboratory
K. AMASYALI, Oak Ridge National Laboratory
Y. CHEN, Oak Ridge National Laboratory
M. OLAMA, Oak Ridge National Laboratory

* 22ISGT0067, Impact of Smart Meter Measurement Granularity on Control Parameters of OLTC in Distribution Networks with PV
M. NAKAMURA, Waseda University
A. KANEKO, Waseda University
S. YOSHIZAWA, Waseda University
H. ISHII, Waseda University
Y. HAYASHI, Waseda University

* 22ISGT0068, Evaluating and Improving Model-Based Assessment of Contextual Data Quality in Smart Grids
D. VERENO, Salzburg University of Applied Sciences
K. POLANEC, Salzburg University of Applied Sciences
C. NEUREITER, Salzburg University of Applied Sciences

* 22ISGT0070, A Practical Adversarial Attack on Contingency Detection of Smart Energy Systems
M. SABOUNCHI, Purdue University
J. WEI-KOCSIS, Purdue University

* 22ISGT0072, An Intelligent Big Data Analytics Method for Two-Dimensional Non-Residential Building Energy Forecasting
C. NICHIFOROV, University of Texas at San Antonio
M. ALAMANIOTIS, University of Texas at San Antonio

* 22ISGT0073, ML-based Anomaly Detection System for DER Communication in Smart Grid
M. ABDELKHALEK, Iowa State University
G. RAVIKUMAR, Iowa State University
M. GOVINDARASU, Iowa State University

* 22ISGT0075, Measurement-based Component-level Load Modeling for Evaluation of a Current-suppressing Loading Scenario for Microgrid Black Start Events
M. MIRZADEH, Leibniz University Hannover
A. MERTENS, Leibniz University Hannover

* 22ISGT0076, Physics-Aware Fast Learning and Inference for Predicting Active Set of DC-OPF
H. KHAZAEI, Stony Brook University
Y. ZHAO, Stony Brook University

* 22ISGT0078, Small-Signal Stability of Low-Inertia Power Grids with Inverter-Based Resources and Synchronous Condensers
L. DING, National Renewable Energy Lab

X. LU, Temple University
J. TAN, National Renewable Energy Lab

* 22ISGT0079, Risk-Adjusted Unit Commitment for Systems with High Penetration of Renewables
D. OSIPOV, Rensselaer Polytechnic Institute
S. NAQVI, Rensselaer Polytechnic Institute
S. PALEPU, Rensselaer Polytechnic Institute
K. KAR, Rensselaer Polytechnic Institute
J. CHOW, Rensselaer Polytechnic Institute
A. GUPTA, Rensselaer Polytechnic Institute

* 22ISGT0080, Prediction of Power Measurements Using Adaptive Filters
K. HAMAD, University of Florida
N. ALJOHANI, University of Florida
T. ZOU, University of Florida
A. BRETAS, University of Florida

* 22ISGT1081, Machine Learning-based Cyber-Physical Anomaly Detection in Wide Area Voltage Control Systems
B. HYDER, Iowa State University
V. K. SINGH, Idaho National Lab
M. GOVINDARASU, Iowa State University
R. NUQUI, Hitachi-ABB Power Grids

* 22ISGT1084, Advanced Persistent Threat (APT)-Style Attack Modeling and Testbed for Power Transformer Diagnosis System in a Substation
S. AHMAD, Texas A&M University-Kingsville
B. AHN, Texas A&M University-Kingsville
D. TREVINO, Texas A&M University-Kingsville
S. ALVEE, Texas A&M University-Kingsville
T. KIM, Texas A&M University-Kingsville
Y-W YOUN, Korea Electrotechnology Research Institute
M-H RYU, Korea Electrotechnology Research Institute

* 22ISGT1086, Three-Phase Distribution Locational Marginal Pricing for Competitive Electricity Markets with Distributed Generators and Flexible Loads
E. MA, Opus One Solutions
A. LODDER, Opus One Solutions
S. GUO, Opus One Solutions
S. MORTAZAVIAN, Opus One Solutions
Y. ZHANG, Opus One Solutions
Z. JAMALUDIN, Opus One Solutions
P. MADABHUSHI, Opus One Solutions
D. OLIVEIRA, Opus One Solutions
W. MUNEER, Opus One Solutions

* 22ISGT1090, A Simple Application for Executing Dynamic Simulations in Parallel on Cluster Machines
M. CARREÑO, GERS
D. RODRIGUEZ, GERS
J. GERS, GERS

* 22ISGT1092, Variation-cognizant Probabilistic Power Flow Analysis via Multi-task Learning
K. CHEN, University of California, Santa Cruz
Y. ZHANG, University of California, Santa Cruz

* 22ISGT1094, Data Compression for Power Distribution System Waveform Measurements
S. ACHARYA, University of Wisconsin-Madison

C. L. DEMARCO, University of Wisconsin-Madison

* 22ISGT1096, A Cryptographic Method for Defense Against MiTM Cyber Attack in the Electricity Grid Supply Chain
S. PAUL, Georgia Institute of Technology
Y-C CHEN, Georgia Institute of Technology
S. GRIJALVA, Georgia Institute of Technology
V. J. MOONEY III, Georgia Institute of Technology

* 22ISGT1097, Impact Analysis and Mitigation of Losing Time Synchronization at Micro-PMUs in Event Location Identification
Z-J YE, University of California, Riverside
M. FARAJOLLAHI, University of California, Riverside
H. MOHSENIAN-RAD, University of California, Riverside

* 22ISGT1098, Differentially Private Load Restoration for Microgrids with Distributed Energy Storage
S. BOSE, University of California, Santa Cruz
Y. ZHANG, University of California, Santa Cruz

* 22ISGT1103, Dynamic Modeling and Model Predictive Control of Hybrid Solid-State Transformers
L. DING, Temple University
Y. DU, Temple University
X. LU, Temple University
A. Q. HUANG, University of Texas, Austin

* 22ISGT1104, Overloading Analysis of Distribution Transformers using Smart Meter Data
V. MUTHUKARUPPAN, North Carolina State University
M. BARAN, North Carolina State University
N. LU, North Carolina State University
P. REHM, ElectriCities of North Carolina Inc.
E. MILLER, P.E., (NRLP)
M. MAKDAD, P.E., (NRLP)

* 22ISGT1105, Hierarchical Model-Free Transactive Control of Residential Building Loads: An Actual Deployment
K. AMASYALI, Oak Ridge National Laboratory
C. WINSTEAD, Oak Ridge National Laboratory
Y. CHEN, Oak Ridge National Laboratory
J. MUNK, Oak Ridge National Laboratory
M. OLAMA, Oak Ridge National Laboratory
J. HILL, Southern Company

* 22ISGT1106, Testing of a Dynamic Power Conditioner for Phase Balancing in Southern California Edison
M. ARIFUJJAMAN, Southern California Edison (SCE)
G. ANDAYA, Southern California Edison (SCE)
J. ARAIZA, Southern California Edison (SCE)
E. HOSSAIN, Oregon Institute of Technology

* 22ISGT1107, Replacing Transmission Infrastructure with Solar and Energy Storage Systems: An Islanded Microgrid Case Study
A. FURLANI BASTOS, Sandia National Laboratories
R. WEED, CleanTech Strategies
T. NGUYEN, Sandia National Laboratories
R. BYRNE, Sandia National Laboratories

* 22ISGT1109, A Hybrid Data-Driven and Model-Based Anomaly Detection Scheme for DER Operation

Y. YAO, National Renewable Energy Laboratory
F. DING, National Renewable Energy Laboratory
W. LIU, National Renewable Energy Laboratory

* 22ISGT1110, Comparative Realistic Objectives Oriented Optimization Framework for EV Charging Scheduling in a Distribution System
H. C. GULDORUM, Yildiz Technical University
A. K. ERENOGLU, Yildiz Technical University
O. ERDINC, Yildiz Technical University
I. SENGOR, University College Cork

* 22ISGT1111, Optimal Voltage Control in Low-Observable Unbalanced Distribution Systems
M. ABUJUBBEH, Kansas State University
J. RANJITH KUMAR R., Kansas State University
A. PAHWA, Kansas State University
B. NATARAJAN, Kansas State University

* 22ISGT1112, Comparative Analysis of Frequency Support Provided by Grid-Forming and Grid-Following PVs
S. BHATTACHARYA, Malta College of Arts, Science, and Technology
B. AZZOPARDI, Malta College of Arts, Science, and Technology

* 22ISGT1113, Prediction of Relay Settings in an Adaptive Protection System
A. SUMMERS, Sandia National Laboratories
T. PATEL, Sandia National Laboratories
R. MATTHEWS, Sandia National Laboratories
M. RENO, Sandia National Laboratories

* 22ISGT1115, Cost Analysis of DCFC Fast Charging Station Power Rates for Workplace Charging
S. KUCUKSARI, University of Northern Iowa
N. ERDOGAN, Robert Gordon University

* 22ISGT1118, Quasi-Dynamic Domain Modeling and Simulation of Voltage Source Converters
K. LIU, Georgia Institute of Technology
A. P. MELIOPOULOS, Georgia Institute of Technology
O. OSAMUYI, Georgia Institute of Technology
S. CAI, Georgia Institute of Technology

* 22ISGT1120, Power System Resilience Evaluation Framework and Metric Review
Y. YAO, National Renewable Energy Laboratory
W. LIU, National Renewable Energy Laboratory
R. JAIN, National Renewable Energy Laboratory

* 22ISGT1121, Advanced Sensor Deployment for Distribution System State Estimation and Fault Identification
P. PAUDYAL, National Renewable Energy Laboratory
U. KUMAR, National Renewable Energy Laboratory
S. VEDA, National Renewable Energy Laboratory
A. COHEN, EGM Ltd.
E. MIRON, EGM Ltd.

* 22ISGT1123, Dymola-Enabled Reinforcement Learning for Real-time Generator Set-point Optimization
A. PIGOTT, University of Colorado Boulder
K. BAKER, University of Colorado Boulder
S. DORADO-ROJAS, Rensselaer Polytechnic Institute
L. VANFRETTI, Rensselaer Polytechnic Institute

* 22ISGT1125, VAC: A Software Approach to Resilient SCADA Automation

J. JOHNSON, Oak Ridge National Laboratory
B. WEBER, Oak Ridge National Laboratory
J. SMITH, Oak Ridge National Laboratory
C. HATHHORN, Oak Ridge National Laboratory
P. IRMINGER, Oak Ridge National Laboratory
S. NOREM, Oak Ridge National Laboratory
J. GUERRA, Oak Ridge National Laboratory
J. DAWSON, Oak Ridge National Laboratory
T. MCDANIEL, Oak Ridge National Laboratory

* 22ISGT1126, A Fast and Accurate Transient Stability Assessment Method Based on Deep Learning: WECC Case Study
Y. ZHAO, University of Tennessee
S. YOU, University of Tennessee
M. MANDICH, University of Tennessee
L. ZHU, University of Tennessee
C. ZHANG, University of Tennessee
H. LI, University of Tennessee
Y. SU, University of Tennessee
Y. LIU, University of Tennessee
H. JIANG, National Renewable Energy Lab
H. YUAN, National Renewable Energy Lab
Y. ZHANG, National Renewable Energy Lab
J. TAN, National Renewable Energy Lab

* 22ISGT1127, Energy Storage-based Packetized Delivery of Electricity
T. NGUYEN, Sandia National Laboratories
R. BYRNE, Sandia National Laboratories

* 22ISGT1128, A Distributed Control Architecture for Optimal Allocation of Grid-responsive Load Aggregations
J. MATHIAS, University of Florida
S. MEYN, University of Florida
H. BALLOUZ, Electric Power Engineers, Incorporated
M. ANSARI, Electric Power Engineers, Incorporated

* 22ISGT1129, Volt-VAR Optimization in Distribution Networks Using Twin Delayed Deep Reinforcement Learning
R. HOSSAIN, University of Nevada Reno
M. GAUTAM, University of Nevada Reno
M. MANSOURLAKOURAJ, University of Nevada Reno
H. LIVANI, University of Nevada Reno
M. BEN-IDRIS, University of Nevada Reno

* 22ISGT1130, Modeling of A Realistic DC Source in A CVSR
M. HAYERIKHIYAVI, University of Central Florida
A. DIMITROVSKI, University of Central Florida

* 22ISGT1131, Investigating the Impact of Electric Vehicles on the Voltage Profile of Distribution Networks
A. FAROKHI SOOFI, San Diego State University
R. BAYANI, San Diego State University
S. D. MANSHADI, San Diego State University

* 22ISGT1132, Simulation and Postmortem Analysis of Angeles Forest Disturbance Event
S. SAMANTA, The Pennsylvania State University
N. RAY CHAUDHURI, The Pennsylvania State University
S. DEBNATH, Oak Ridge National Laboratory

D. PIPER, Southern California Edison

* 22ISGT1133, Feasibility of a Real-world Test Microgrid Facility to Provide Economic and Resiliency Benefits in Extreme Weather Conditions
R. BHATTA, Texas Tech University
R. SHRESTHA, Texas Tech University
C. A. NEGRI, Texas Tech University
K. E. KORK SCHMITT, Texas Tech University
I. OSMAN, Texas Tech University
M. CHAMANA, Texas Tech University
M. MURSHED, Texas Tech University
S. BAYNE, Texas Tech University

* 22ISGT1134, Learning to Solve Transmission Constrained Unit Commitment Using Generation Shift Factors
T. IQBAL, West Virginia University
H. UL BANNA, West Virginia University
A. FELIACHI, West Virginia University

* 22ISGT1135, Importance of Model Fidelity of Power to X Devices in Energy System Analysis
D. GUSAIN, TU Delft
M. CVETKOVIC, TU Delft
B. CANER YAGCI, TU Delft
P. PALENSKY, TU Delft

* 22ISGT1136, Regional PV Energy Forecasting using Distributed Data and Deep Neural Networks
L. P. FRANCO, Universidade Federal do Rio Grande do Sul
P. HIRMER, University of Stuttgart
L. H. THOM, Universidade Federal do Rio Grande do Sul

* 22ISGT1137, OPF-Learn: An Open-Source Framework for Creating Representative AC Optimal Power Flow Datasets
T. JOSWIG-JONES, University of Washington
K. BAKER, University of Colorado
A. ZAMZAM, National Renewable Energy Laboratory

* 22ISGT1139, A Bagging MLP-based Autoencoder for Detection of False Data Injection Attack in Smart Grid
R. K. KUNDU, University of Rostock
S. PAUL, Georgia Institute of Technology

* 22ISGT1140, A Novel Methodology for Cybersecurity Investment Optimization in Smart Grids using Attack-Defense Trees and Game Theory
B. HYDER, Iowa State University
M. GOVINDARASU, Iowa State University

* 22ISGT1141, Evaluation of Optimal Net Load Management in Microgrids using Hardware-in-the-Loop Simulation
J. WANG, NREL
S. CHAKRABORTY, University of Minnesota
V. KHATANA, University of Minnesota
B. LUNDSTROM, Enphase Energy
G. SARAWAT, NREL
M. SALAPAKA, University of Minnesota

* 22ISGT1150, Substation-level Circuit Topology Estimation Using Machine Learning
D. RUIZ GARCIA, University of New Mexico
B. POUDEL, University of New Mexico

A. BIDRAM, University of New Mexico
M. RENO, Sandia National Laboratories

* 22ISGT1160, Microgrid Controller Evaluation Using Real-Time Digital Simulation
A. AVENDANO, PG&E

* 22ISGT1161, Impact of PV Farms with Smart Inverters on the Protection of Distribution System
P. RAGHURAMAN, North Carolina State University
M. BARAN, North Carolina State University

* 22ISGT1162, Robust Autoencoder-based State Estimation in Power Systems
M. PICOT, Université Paris Saclay
F. MESSINA, Universidad de Buenos Aires
F. LABEAU, McGill University
P. PIANTANIDA, Université Paris Saclay

* 22ISGT1163, Day-ahead Load Forecasting using Explainable Artificial Intelligence
D. A. BOLSTAD, Norwegian University of Science and Technology
U. HALDEN, Norwegian University of Science and Technology
U. CALI, Norwegian University of Science and Technology
M. KUZLU, Old Dominion University

* 22ISGT1165, A Dual-mode Real-time Electrical Load Forecasting Framework
X. WANG, UC Irvine
M. PAPAEFTHYMIOU, UC Irvine

* 22ISGT1166, Security Monitoring of the Microgrid Using IEC 62351-7 Network and System Management
M. KARANFIL, Concordia University
D. ELHAK REBBAH, Concordia University
M. GHAFOURI, Concordia University
M. KASSOUF, Hydro-Qu´ebec's Research Institute (IREQ)
M. DEBBABI, Concordia University
A. HANNA, Concordia University

* 22ISGT1167, Hardening Substations against Supply Chain Attacks Under Operational Constraints
O. DUMAN, Concordia University
L. WANG, Concordia University
M. AU, Hydro-Qu´ebec's Research Institute (IREQ)
M. KASSOUF, Hydro-Qu´ebec's Research Institute (IREQ)
M. DEBBABI, Concordia University

* 22ISGT1168, Using Terminal Circuit for Power System Electromagnetic Transient Simulation
Y. LIU, Texas A&M University
X. ZHANG, GEIRINA
R. DAI, GEIRINA
G. LIU, GEIRINA

* 22ISGT1170, Real-Time Co-simulation Platform for Security Analysis of Distribution Automation Systems
D. E. REBBAH, Concordia University
A. EBTIA, Concordia University
M. GHAFOURI, Concordia University
M. KASSOUF, Hydro Quebec
R. ATALLAH, Hydro Quebec
M. DEBBABI, Concordia University
A. MOHAMMADI, Concordia University

* 22ISGT1171, Positive-Sequence Phasor Modeling of Droop-Controlled, Grid-Forming Inverters with Fault Current Limiting Function
W. DU, Pacific Northwest National Lab
Y. LIU, Pacific Northwest National Laboratory
R. HUANG, Pacific Northwest National Laboratory
F. TUFFNER, Pacific Northwest National Laboratory
J. XIE, Pacific Northwest National Laboratory
Z. HUANG, Pacific Northwest National Laboratory

* 22ISGT1173, Online Optimization of Heat Pump Systems for Building Heating based on Lyapunov Method
M. CAO, Southern University of Science and Technology
S. CHEN, Southern University of Science and Technology
Z. YANG, Southern University of Science and Technology
H. MIAO, Southern University of Science and Technology

* 22ISGT1174, Deploying 5G architecture for protection systems in smart distribution grids
C. ADRAH, Norwegian University of Science and Technology
D. PALMA, Norwegian University of Science and Technology
Ã˜. KURE, University of Oslo
P. HEEGAARD, Norwegian University of Science and Technology

* 22ISGT1175, A Privacy-Preserving Three-Step Demand Response Market Using Multi-Party Computation
F. ZOBIRI, KU Leuven
M. GAMA, KU Leuven
S. NIKOVA, KU Leuven
G. DECONINCK, KU Leuven

* 22ISGT1176, Scheduling of the HVAC System in a Real Commercial Building Considering Equipment Cycling and Rebound Effects
S. FADDEL, University of Central Florida
Q. ZHOU SUN, University of Central Florida
G. TIAN, University of Central Florida
A. PARLATO, University of Central Florida
J. TAYLOR, Siemens

* 22ISGT1179, An Experiment-based Distribution Level Performance Comparison among PMUs</pre>
H. YIN, the University of Tennessee
L. ZHAN, ORNL
W. YAO, Dept. of Electrical Engineering and Computer Science
Y. LIU, the University of Tennessee

* 22ISGT1180, Quantitative Analysis of Demand Response Using Thermostatically Controlled Loads
P. DHANASEKAR, University of Houston
C. ZHAO, University of Houston
X. LI, University of Houston

* 22ISGT1182, Standardization of Smart Contracts for Energy Markets and Operation
U. CALI, NTNU
D. SEBASTIAN-CARDENAS, PNNL
S. SAHA, EPRI
S. CHANDLER, Guidehouse, Inc
S. N. G. GOURISETTI, PNNL
T. HUGHES, TMH Ventures, LLC
K. KHAN, University of Oviedo
C. LIMA, Blockchain Engineering Council (BEC)
F. RAHIMI, Open Access Technology International, Inc

L. TILLMAN, Balch & Bingham LLP

* 22ISGT1183, Synchrophasors-based Master State Awareness Estimator for Cybersecurity in Distribution Grid: Testbed Implementation & Field Demonstration
M. ALANZI, University of Idaho
H. CHALLA, University of Idaho
H. BELEED, University of Idaho
D. REEN, Idaho National Laboratory
V. K. SINGH, Idaho National Laboratory
B. K. JOHNSON, University of Idaho
Y. CHAKHCHOUKH, University of Idaho
J. BELL, Idaho National Laboratory
C. RIEGER, Idaho National Laboratory
J. GENTLE, Idaho National Laboratory

* 22ISGT1184, Cyberattacks against Direct Load Control of Residential Electric Water Heaters in Smart Grids
E-N YOUSSEF, McGill University
M. KASSOUF, Hydro-Quebec Research Institute
S. ALARIE, Hydro-Quebec Research Institute
F. LABEAU, McGill University

* 22ISGT1185, Testing Machine Learned Fault Detection and Classification on a DC Microgrid
S. OJETOLA, Sandia National Laboratories
M. RENO, Sandia National Laboratories
J. FLICKER, Sandia National Laboratories
D. BAUER, Emera Technologies LLC
D. STOLTZFUZ, Emera Technologies LLC

* 22ISGT1186, Physics-Aware Sparse Harmonic State Estimation in Power Distribution Systems
F. AHMADI GORJAYI, University of California, Riverside
H. MOHSENIAN-RAD, University of California, Riverside

* 22ISGT1188, Reliability assessment of patched SCADA EMS/DMS servers through similarity matching
J. BISWAS, Singapore University of Technology and Design
D. YAU, Singapore University of Technology and Design
M. YU, Power Automation Pte Ltd
I-L KON, Power Automation Pte Ltd
Z. LI, Singapore University of Technology and Design
K. TAN, Power Automation Pte Ltd
Z. ZHANG, Power Automation Pte Ltd
J. CHUA, Power Automation Pte Ltd
W. TSO, Power Automation Pte Ltd
Y. HENG, Power Automation Pte Ltd

* 22ISGT1189, Power hardware-in-the-loop-based diesel generator for flexible microgrid testing applications
N. SEUBERT, Electricité de France
N. STANKOVIC, Electricité de France
E. TOUTAIN, Electricité de France

* 22ISGT1190, Knowledge-Based Fault Diagnosis for a Distribution System with High PV Penetration
S. PAUL, Georgia Institute of Technology
S. GRIJALVA, Georgia Institute of Technology
M. JIMENEZ APARICIO, Sandia National Laboratories
M. J. RENO, Sandia National Laboratories

* 22ISGT1191, A Machine Learning-based Method using the Dynamic Mode Decomposition for Fault Location and Classification
F. WILCHES-BERNAL, Sandia National Labs
M. JIMÉNEZ-APARICIO, Sandia National Labs
M. RENO, Sandia National Labs

* 22ISGT1192, Voltage Regulation and Energy Management for Fuel Cell-Ultracapacitor Hybrid Electric Vehicle
M. KHALID, King Fahd University of Petroleum and Minerals

* 22ISGT1194, IoT-Enabled Decentralized Moving Target Defense for Enhancing Privacy in Microgrid Control
J. GIRALDO, University of Utah
M. PARVANIA, University of Utah

* 22ISGT1196, Allocating Reserves in Active Distribution Systems for Tertiary Frequency Regulation
M. GAUTAM, University of Nevada, Reno
M. MANSOURLAKOURAJ, University of Nevada, Reno
N. BHUSAL, University of Nevada, Reno
M. BEN-IDRIS, University of Nevada, Reno
H. LIVANI, University of Nevada, Reno

* 22ISGT1199, Black-Start of HVDC-Connected Offshore Wind Generators for System Restoration
L. HE, University of Illinois Chicago

* 22ISGT1200, Detection of Stealthy False Data Injection Attacks in Unobservable Distribution Networks
J. R. K. RAJASEKARAN, Kansas State University
B. NATARAJAN, Kansas State University
A. PAHWA, Kansas State University
H. WU, Kansas State University

* 22ISGT1202, Resilient Periodic Observer-based Control for Wide Area Oscillation Damping Against Time Synchronization Attacks
S. VAHIDI, Concordia University
A. AMINI, Concordia University
M. GHAFOURI, Concordia University
M. AU, Hydro-Quebec
A. MOHAMMADI, Concordia University
M. DEBBABI, Concordia University

* 22ISGT1203, A Cyber-Physical Resilience-Based Survivability Metric against Topological Cyberattacks
A. RAHIMINEJAD, Concordia University
M. GHAFOURI, Concordia University
R. ATALLAH, Hydro-Qu´ebec's Research Institute (IREQ)
A. MOHAMMADI, Concordia University
M. DEBBABI, Concordia University

* 22ISGT1204, Resilient Predictor-Based Load Frequency Control for Multi-Region Power Systems Under DoS Attacks
Z. WANG, URI
W. DANILCZYK, URI
H. LI, URI
H. HE, URI
Y. SUN, URI

April 28, 2022 (Thursday)

Net Solar & Load Forecasting for a Decarbonizing Grid: Industry Perspectives and Ongoing Research (panel session)
Location - Room 391-392
Thursday, April 28, 2022 10:30 AM-12:00 PM
Session Chair: Soumya Kundu and Andy Reiman, PNNL

High quality forecasts reduce operational uncertainty in a decarbonizing grid, improving resource flexibility as well as hosting capacity for DER. Recent improvements in solar forecasting have enhanced the productivity of community- and utility-scale solar projects. Forecasting of multi-modal net load signals requires additional data streams but will improve load balancing and PV hosting capacity both behind-the-meter and at utility scale (e.g., substation load). This panel will discuss industry perspectives and ongoing research on net load forecasting.

Presentations and Panelists:

- "Net Load Forecasting to Improve Solar Hosting Capacity and Resilience" by S. Kundu, PNNL
- "SETO-Funded Research on Net Load Forecasting" by T. Golnas, Solar Energy Technologies Office, U.S. DOE
- "A Utility-Driven Data Science Approach to Integrating Solar Net-Load Forecasting into System Operations" by A. Eiden, Portland General Electric
- "Adaptation of Net Load Inference to Determine PV Settings" by S. Dise, Clean Power Research

"An Advanced AI/ML Algorithm for Probabilistic Time-Series Forecast" by I. Chakraborty, Lawrence Livermore National Laboratory

Data Analytics and Machine Learning for Power System Monitoring and Operation: An Industrial Perspective (panel session)
Location - Room 386
Thursday, April 28, 2022 10:30 AM-12:00 PM
Session Chair: Yichen Zhang and Tianqi Hong, Argonne National Laboratory

With the increasing deployment of advanced sensors, power system operators have been collecting significant amounts of data. These multi-domain multi-resolution data (PMUs, SCADA, Weather, GIS, etc.) provide an opportunity to level up the intelligence of the modern power system. Advanced data analytics and machine learning enable health status predictions, prompt anomaly detections, and autonomous decision-making in a distributed or decentralized fashion. These capabilities are essential for accommodating more intermittent renewable and facilitating grid decarbonization.
Nowadays, machine learning frameworks and their applications have been extensively studied by power system academia. However, the challenges in real-world scenarios and the pathway to field deployment are still not clear. In this panel session, we present a series of successful stories, R&D efforts, pilot projects, and visions from broader industrial members, including utilities, electric research institutes, and national labs, about the applications of data analytics and machine learning for distributed and decentralized decisions and control. Our ultimate goal of this panel session is to connect cutting-edge data analytics and machine learning theories to real-world problems and show the pathway for artificial intelligence-based technology landing to address challenges in the process of grid decarbonization.

Presentations and Panelists:

- "Data Driven Grid Dynamics Discovery and Analysis" by C. Mishra, Dominion Energy
- "Data Analytics for DER Forecasting, Monitoring and Control in Distribution Systems" by H. Zheng, Commonwealth Edison Co

- "The Learning to Run a Power Network Challenge 2021 – The Search for a Control Center Digital Assistant" by A. Kelly, Electric Power Research Institute
- "Data-Driven Optimization for Voltage Control of Networked Microgrids" by T. Hong, ANL

Microgrids – Perspective & Experience from Utilities, DOE and National Labs (panel session)
Location - Room 398 - 399
Thursday, April 28, 2022 10:30 AM-12:00 PM
Session Chair: Muhidin Lelic, Quanta Technology, LLC

This panel session is intended to present challenges and experience in design, implementation and testing of microgrids, from perspective of Commonwealth Edison Company (ComEd), one of utilities that has been actively involved in various aspects of microgrid research, development and implementation.
As part of these activities, ComEd has been working with Department of Energy, national labs, academia and industry addressing various aspects of research, development and implementation, such as microgrid monitoring and control, integration of DER, protection, integration of microgrid management system within SCADA and ADMS, microgrid clustering and other relevant problems. One of the objectives of this panel session is to bring perspectives from other participants in this technology, such as Department of Energy EERE System Integration Technology Office (SETO) that has been instrumental in supporting of various aspects of the technology; National Renewable Energy Laboratory (NREL) that has been developing and testing state of the art architectures for integration of wide area networks, including ADMS, Microgrids, and various DERs, as well as ComEd own experience

Presentations and Panelists:

- "Integration of Microgrids In Distribution Networks – Perspective & Experience from Utilities, DOE and National Labs" by M. Lelic, Quanta Technology, LLC
- "Solar PV, Microgrids and Communities" by G. Yuan, Department of Energy
- "Testing of MG Control Systems using Real-Time Power HIL" by H. Zheng, Commonwealth Edison Company
- "Microgrids Sequence of Operation: Planned Islanding use case" by A. Vukojevic, Commonwealth Edison Company
- "Integration of MG, DER Aggregators and DERMS with ADMS" by A. Pratt, National Renewable Energy Laboratory

Distributed Controls to Leverage DER in Grid Operations (plenary panel session)
Location - Room 391-392
Thursday, April 28, 2022 1:00 PM-2:30 PM
Session Chair: James Ogle, Pacific Northwest National Laboratory

Aggressive decarbonization goals, customer preferences, and falling costs are accelerating the adoption of renewable technologies and energy storage in the electric distribution system. The traditional grid structure is transforming to a more integrated transmission and distribution system with energy resources distributed throughout the grid and many more non-utility owned resources connected. The result is more variability in supply and load with more localized effects. This has broad consequences to the electric utility that must integrate these new technologies while still maintaining a reliable, resilient, and cost-effective distribution system operations. While operations are becoming more complex, the availability of these energy resources in the distribution system offers new opportunities to leverage them to improve efficiency, resiliency, and equity across the grid. Traditional centralized control schemes are challenged to operate in a timely fashion as the scale of the local resources, participants, and intelligent devices increases limiting their capability to manage and optimize these distributed resources. Distributed control approaches, where the optimization problem is decomposed into a set of smaller sub-problems hold promise to manage both scale and response

time through layered coordination amongst a set of cooperating nodes. In this panel we will explore the opportunities and challenges in developing and deploying distributed control approaches to better leverage distributed energy resources in distribution system operations.

Presentations and Panelists:

- "Leveraging DER in Distribution Operations" by J. Gibson, Avista Utilities
- "Distributed Approach for Resilient DER Assisted Restoration" by A. Dubey, Washington State University
- "Platform Approach for Distributed Operations" by A. Reiman, Pacific Northwest National Laboratory
- "Lessons Learned from Designing Edge Ready Distributed Controls" by B. Fazzari, Schweitzer Engineering Laboratories