Please make your plans for another exciting IEEE PES T&D Conference. The 2020 conference returns to Chicago, where we anticipate the biggest and best show ever. Shay Bahramirad and the local organizing team from host utility ComEd have put together a fantastic combination of events that will exceed the expectations of all attendees. POWER FORWARD 2020 features a few new experiences to keep up with the unprecedented pace of global trends to maintain the T&D Conference as the best and biggest in the industry. In addition to our traditionally strong technical program and world-class exhibit hall, the Chicago team has made some exciting changes to ensure an even more valuable experience. We will have a Smart Cities Pavilion featuring the latest advances to highlight how the electric utility industry is the key driver of the interconnections and technology that will shape the cities of the future. Innovation stages have been added to the exhibit hall where vendors and innovators can present technical topics and trends, and a new Media Pavilion will provide better access and coverage of the companies and teams making a difference. And as always, sign up early for the great selection of technical tours — they sell out fast.

Our exhibitors often use the T&D Conference as the place to launch new technology and equipment. We have added a T&D Utility Saver package providing a great discount to encourage more utility attendees to see and experience what the vendors have to offer and enjoy the best and broadest technical program in the world. Whether your focus is equipment specific or broad and strategic, we have something for everyone.

New hotels and restaurants have been added near McCormick Place to make it even easier for those who want to be near the exhibit hall. Attendees will be able to see why Chicago remains one of the most popular cities in the world with its museums, interesting restaurants and nightlife, in a place with rich history and traditions. Don't miss our signature social event, the opening reception on Monday night at the historic Field Museum of Natural History.

We are blessed to work in an industry that is at the lead in shaping the future of our world. There are so many conferences and expositions to choose from. If you can only attend one — the IEEE PES T&D Conference is your best choice. Our show covers the broad spectrum from Transmission to Distribution and from Automation/IoT to the variety of new and innovative equipment that constitute the grid. This is the best place to see the technical trends as well as the strategic issues our key industry leaders are talking about.

We can't wait to welcome you to Chicago in April 2020.
“GOOD FORTUNE IS WHAT HAPPENS WHEN OPPORTUNITY MEETS WITH PLANNING.” — THOMAS EDISON

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## SCHEDULE AT A GLANCE

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### PERSONALIZE YOUR CONFERENCE EXPERIENCE WITH THE T&D MOBILE APP

SEARCH, PLAN AND ORGANIZE YOUR AGENDA:
- Maps
- Exhibitors
- Sessions
- Speakers
- Scheduled appointments
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**SUNDAY, APRIL 19**

- 12:00pm - 5:00pm Registration Open

**MONDAY, APRIL 20**

- 7:00am - 5:00pm Registration Open
- 7:30am - 4:00pm Technical Tours
- 7:30am - 5:00pm Plain Talk
- 8:00am - 5:00pm Tutorials
- 8:30am - 4:30pm IEEE Leading Technical Teams Workshop
- 6:00pm - 9:00pm Conference Opening Reception

**TUESDAY, APRIL 21**

- 7:00am - 5:00pm Registration Open
- 7:30am - 5:00pm Plain Talk
- 8:30am - 10:00am Opening Session
- 8:30am - 4:00pm Technical Tours
- 10:15am - 5:00pm Exhibits Open / Innovation Stages and Smart Cities Pavilion
- 10:15am - 5:15pm Technical Panel and Forum Sessions
- 11:30am - 1:00pm Conference Luncheon
- 3:30pm - 5:30pm Super Session
- 5:30pm - 7:30pm Women in Power, Young Professionals and Collegiate Reception

**WEDNESDAY, APRIL 22**

- 7:00am - 5:00pm Registration Open
- 7:30am - 5:00pm Plain Talk
- 8:00am - 10:00am Super Session
- 8:00am - 4:30pm Technical Tours
- 10:00am - 6:00pm Exhibits Open / Innovation Stages and Smart Cities Pavilion
- 10:15am - 5:15pm Forum Sessions
- 1:00pm - 5:15pm Technical Panel Sessions
- 4:30pm - 6:00pm Networking Reception
- 5:00pm - 7:00pm Poster Session and Reception / Student Poster Contest (exhibitors welcome after 6 pm)

**THURSDAY, APRIL 23**

- 7:00am - 2:00pm Registration Open
- 8:00am - 10:00am Super Session
- 8:00am - 12:15pm Forum Sessions
- 8:30am - 4:30pm Technical Tours
- 10:00am - 2:00pm IEEE PES High School Power Challenge Presentation
- 10:00am - 3:00pm Exhibits Open / Innovation Stages and Smart Cities Pavilion
- 10:15am - 3:00pm Technical Panel Sessions
- 3:30pm - 4:00pm Closing Reception and Raffle

The 2020 IEEE PES T&D Conference and Exposition would like to thank and recognize the following companies that have generously sponsored portions of this year’s conference.

- ABB Inc.
- Aecom Power E&C, Inc.
- Delta Star, Inc.
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- G&W Electric Company
- Hubbell Utility Solutions
- Leidos
- Leidos
- POWER Engineers, Inc.
- Quanta Services
- Saber Power Services
- Schweitzer Engineering Laboratories, Inc.
- Siemens

CHICAGO, ILLINOIS
LOCATION
The 2020 IEEE PES T&D Conference and Exposition will be located at McCormick Place South in Chicago, Illinois. For directions and other useful information visit https://mccormickplace.com/getting-here/.

REGISTRATION
To take advantage of Early Bird pricing, register by March 20, 2020.
Online: IEEE-T-D.org / Questions: 508.743.8573

HOTEL RESERVATIONS
We’ve partnered with Connections Housing to provide the lowest rates at over 20 major hotels in prime locations. While some of the hotels are within walking distance to McCormick Place South, most will be serviced by complimentary shuttle buses starting Monday, April 20 and running through Thursday, April 23.

RESERVATIONS
Book by March 27, 2020
Online: IEEE-T-D.org
Telephone: 844-677-5455
Email: ieeehousing@connectionshousing.com

HOUSING ASSISTANCE
Connections Housing will be onsite should you need assistance with any of the conference hotels during your stay in Chicago.

HOURS OF OPERATION
Tuesday, April 21: 8:00am – 5:00pm
Wednesday, April 22: 8:00am – 5:00pm
Thursday, April 23: 8:00am – 3:00pm

Be sure to look for the official T&D housing logo to ensure you are receiving the best rates and service.

EXPLORE CHICAGO
Make the most of your stay by visiting https://chicagoconcierge.com/events/ieee/ to discover the windy city’s many culinary, entertainment and shopping experiences.

HOTELS

1. Chicago Marriott Downtown Magnificent Mile (3.1 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

2. Courtyard by Marriott Chicago Downtown Magnificent Mile (3.4 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

3. Embassy Suites by Hilton Chicago Downtown Magnificent Mile (3.0 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

4. Embassy Suites Chicago (3.5 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

5. Fairmont Chicago Millennium Park (3.0 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

6. Hampton Inn by Hilton Chicago McCormick Place (0.3 miles)
Walking distance to McCormick Place South

7. Hilton Chicago (1.7 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

8. Hilton Garden Inn Chicago Downtown Magnificent Mile (3.8 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

9. Hilton Garden Inn Chicago McCormick Place (0.3 miles)
Walking distance to McCormick Place South

10. Home2 Suites by Hilton Chicago McCormick Place (0.3 miles)
Walking distance to McCormick Place South

11. Hyatt Regency Chicago (3.3 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

12. Hyatt Regency McCormick Place (0.3 miles)
Walking distance to McCormick Place South

13. InterContinental Chicago Magnificent Mile (2.8 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

14. Loews Chicago Hotel (2.8 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

15. Marriott Marquis Chicago (0.2 miles)
Walking distance to McCormick Place South

16. Palmer House, A Hilton Hotel (2.2 miles)
Shuttle provided to McCormick Place South; approx. 20 minutes

17. Radisson Blu Aqua Hotel Chicago (2.6 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

18. Royal Sonesta Chicago Riverfront (3.1 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

19. Sheraton Grand Chicago (2.6 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

20. Swissotel Chicago (2.6 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes

21. The Blackstone Hotel, Autograph Collection (1.7 miles)
Shuttle provided to McCormick Place South; approx. 25 minutes
TECHNICAL PROGRAM
Monday, April 20 - Thursday, April 23

From cyber security and renewable energies and storage to integrating DERs and advanced grid controls, this year’s Technical Program will deliver an unprecedented combination of more than 100 technical sessions featuring the hottest topics surrounding our industry. Join energy sector executives, engineers and thought-leaders for a dynamic line-up of Super Sessions, Panel Sessions, Tutorials and Paper Forum Sessions you’ll only find at T&D. You can even capture Professional Development Hours (PDH) by attending Technical Sessions, with Continuing Education Units (CEU) available for Tutorials, Plain Talk and Leading Technical Teams courses. Details on how to obtain these certificates will be provided at the conference.

EXHIBIT HALL
Tuesday, April 21 - Thursday, April 23
Exhibit Hall Hours

With over 800 exhibitors from around the globe under one roof, there’s simply no better place to explore the newest technologies, products and services covering every aspect of transmission and distribution.

CONFERENCE LUNCHEON
Tuesday, April 21
11:30am - 1:00pm

Enjoy lunch served to you in the exhibitor halls while exploring real-world applications and the emerging technology and product solutions key to our industry’s future success.

NEW IN 2020!

IEEE LEADING TECHNICAL TEAMS WORKSHOP
Monday, April 20
8:30am - 4:30pm

Designed to increase team engagement, improve organization effectiveness and team collaboration, and enhance leadership capability, the IEEE Leading Technical Teams Workshop will guide participants in building and expanding leadership capability with specific focus on the uniqueness of leading technical talent.

SMART CITIES PAVILION
Tuesday, April 21 - Thursday, April 23
Exhibit Hall Hours

Explore this new pavilion to hear how others are inspiring and driving future smart city development. The Smart Cities Pavilion will provide networking spaces to facilitate discussions on the current state of the smart city landscape, the emerging challenges on issues such as climate change, increasing congestion, food insecurity, education, economic development, health and public safety, to name a few. The Smart Cities Pavilion will provide a dedicated space to facilitate discussions on the exciting work being done on this front, and educate, inspire and drive future smart city development. Explore this new pavilion to hear how others are helping to make smarter cities a reality, as well as to connect with companies dedicated to leading smart city transformation.

INNOVATION STAGES
Tuesday, April 21 - Thursday, April 23
Exhibit Hall Hours

Come engage with industry professionals and companies while they share their newest innovations, insights, best practices and practical applications in the exhibit hall. Visit IEEEET-D.org for a complete schedule.

Supported by:
ABB Inc.
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KAPPA Optronics, Inc.
RTDS Technologies
S&C Electric Company

MEDIA STAGE
Tuesday, April 21 - Thursday, April 23
10:00am – 2:00pm

Supported by host utility ComEd’s STEM Programs, local high school student teams will be presenting innovative projects they’ve created relative to one of four energy-related topics, including: Generation, transmission and substations; distribution; or renewables. Students will be given the opportunity to choose a type of project – innovation (prototype), study or experiment, and then bring them to life in the exhibit hall.
COLLEGIATE AND YOUNG PROFESSIONALS PROGRAMS

Offering an exciting and comprehensive schedule of student and young professional sessions and activities, the Collegiate Program is designed to help new talent launch successful careers in the power and energy industry. For a complete schedule of student and young professional activities visit IEEE-G.org.

STUDENT BREAKFAST
Tuesday, April 21 – Thursday, April 23 / 7:00am – 8:00am
Graduate and undergraduate students registered for the conference are invited to a complimentary breakfast with a fun ice-breaker exercise on Tuesday and Wednesday that will help students get to know each other before the day starts.

TELLING YOUR UNIQUE STORY WITH A PERSONAL BRAND
Tuesday, April 21 / 10:15am – 11:45am
Regardless of age, job title or industry, how you express your values, strengths and interests influences how others experience you, and the actions they take to support your career success. In this workshop, you’ll learn what a personal brand is, why it is an important tool in career management, and identify the brand you want to be known for.

CONFERENCE LUNCHEON
Tuesday, April 21 / 11:45am – 1:00pm
Grab a bite, walk the aisles and experience and identify the brand you want to be known for.

TOUR OF EXHIBIT FLOOR WITH YOUNG PROFESSIONALS
Wednesday, April 22 / 8:00am – 9:30am
Young professionals from various companies will guide an exclusive student tour of the exposition floor before it opens Wednesday morning. With over 800 exhibitors, this will be a unique experience for students interested in the power industry.

HOW TO ENGINEER YOUR SUCCESS
Wednesday, April 22 / 9:45am – 11:45am
Would you like more success? Do you feel stuck in some area? Are you ready to try something new? You will leave this session with a deeper understanding of how your mind works and the next steps to take in your journey.

SPEED NETWORKING STUDENT LUNCH
Wednesday, April 22 / 12:00pm – 2:00pm
Join young professionals from various companies for an opportunity to interact, learn and develop important industry contacts during this unique networking lunch.

TRENDS AND EMERGING TECHNOLOGY IN THE POWER INDUSTRY
Wednesday, April 22 / 3:15pm – 5:15pm
The power industry is constantly evolving with new technologies and innovations. Today, young professionals are playing an ever larger role in shaping an increasingly complex energy landscape, utilizing innovation to drive growth, and fundamentally transforming the industry to be more sustainable, resilient and reliable. This Young Professionals panel features executives and leaders as they share perspectives on ways to progress in this competitive learning environment, providing advice and expertise on driving technological innovation forward, as well as answering questions about professional development and increasing one’s impact as a leader in this environment.

POSTER SESSION AND RECEPTION
Wednesday, April 22 / 5:00pm – 7:00pm
Enjoy light hors d’oeuvres and the wide variety of posters competing in the Student Poster Contest with a chance to talk to the students conducting the research.
TUT-02
GIS / GIL HOT TOPICS
8:00am – 12:00pm
Presenters:
Peter Grossmann, Siemens AG
George Becker, POWER Engineers, Inc.
Arnaud Ficheux, GE
Patrick Fitzgerald, AZZ
Hermann Koch, Siemens AG
Bobby Rich, Dominion
Dave Mitch, Dominion
Michael Novev, Burns & McDonnell
Scott Scharf, Tennessee Valley Authority

This tutorial will concentrate on the latest technologies used in Gas-Insulated Substations (GIS) and Gas-Insulated Lines (GIL). The first tutorial section presents alternative gas mixtures to sulphur hexafluoride (SF6) available for dielectric insulation and for circuit breaker switching. Resiliency enhancements to the power delivery system from the application of GIS will be presented to assist project decision-makers during the scope development and decision process when considering design options for high voltage substations. There has been an increase in demand for Mobile GIS to realize fast power supply after grid failures caused by natural disasters or component failures and find use for early grid connections of cost intensive systems such as wind parks. Downtime reductions and substation expansions are explained to further increase the reliability of utility power grids. GIS and GIL trends and developments including digital sensors and monitoring will be introduced. Experience exchange, questions and answers will close this future-oriented tutorial.

TUT-04
EAOLIAN VIBRATION, GALLOPING & SUB-SPAN OSCILLATIONS AND CONDUCTOR MOTION MANAGEMENT
8:00am – 12:00pm
Presenter:
Jeff Wang, Engineering & Technology Solutions

Overhead conductor motion (aeolian vibration, galloping and sub-span oscillations) has been an operation and maintenance issue for about eight decades, but conductor motion is still causing problems to utilities. This tutorial will review aeolian vibration, galloping and sub-span oscillations, and conductor and hardware problems caused by conductor motion; discuss the state-of-art conductor motion mitigation technologies and methodologies; and review lessons learned by utilities and the issues caused at the line design stage. This tutorial will also discuss conductor motion management and preventive measures to improve resilience of transmission lines.
systems; engineering of energy storage systems, interconnection with the grid (e.g. IEEE 1547); energy management systems, commissioning, system safety and reliability; and code compliance.

**TUT-05 STABILIZING THE FUTURE TRANSMISSION GRID USING DYNAMIC VAR TECHNOLOGIES**
8:00am – 5:00pm

**Presenters:**
Andrew Steffen, Sargent & Lundy
Septimus Boshoff, PSD Consulting
Martin Cameron, Xcel Energy
Mikael Halonen, ABB Inc.
Geza Joos, McGill University
Julie Lacroix, Hydro Quebec
David Langner, Siemens
Jan Paramalingan, MEPPi
Joe Warner, ABB Inc.

Due to changing utility infrastructure with regard to conventional generation retirement and increased levels of renewables, dynamic shunt compensation solutions (e.g. SVC, STATCOM, synchronous condensers) are becoming even more vital for transmission system operation and reliability.

Historically, AC transmission shunt compensation is primarily used to maximise transmission capacity. Nowadays, system stability is a primary concern during major disturbances. As utility requirements become more complex, the optimal solution may be a combination of the available and future technology. This tutorial presents planning and specifying approaches, technology principles with example installations, a comparative evaluation of performance and an analysis of future trends expected to influence the technology development and its place in the market. The technology includes mechanically switched shunts, synchronous condensers, static var compensators (SVC), static synchronous compensators (STATCOM) and hybrid STATCOMs.

**TUT-07 INFRASTRUCTURE ASSET MANAGEMENT WITH POWER SYSTEM APPLICATIONS**
8:00am - 5:00pm

**Presenter:**
Lina Bertling Tjernberg, KTH Royal Institute of Technology

The value of making smart decisions gives a reason for adopting asset management (AM). AM is defined as a coordinated activity of an organization to realize value from assets. The first step of AM is always the motivation. This tutorial has two main parts; one is generic related to infrastructure asset management including reliability and maintenance theories and tools, and the other is specific, with applications for the electric power system. The applications presented include a wide selection of different case studies. The case studies include examples from both system studies and component studies. The system studies include different parts of a power system including electrical distribution systems, wind power systems and hydropower systems. The component studies, for example-breakers, transformers and gearboxes, show examples of proposed reliability and maintenance models.

The case studies show examples of different input data, theories and models, and solution techniques. It is shown that in performing these types of studies there would always be a need of both systematic models based on underlying theories, and on specific experience and knowledge of the actual system and its equipment.

**TUT-09 DISTRIBUTION AUTOMATION AND MANAGEMENT SYSTEMS WITH HIGH Penetration of DERs and MICROGRIDS**
8:00am – 5:00pm

**Presenters:**
Jiayuan Fan, PhD, Southern States, LLC
John D. McDonald, GE Grid Solutions

This course will cover the following break-down topics: the roles of Smart Distribution in Smart Grid and Grid Modernization; the overall framework and architecture of DA/DMS in Smart Distribution; Distribution System modeling for automation, operation analysis, and management; advanced real-time and analytic applications in DA/DMS; DERs and microgrids operation and integration in Advanced DMS (ADMS), including DERs/Microgrids connection/disconnection to/from the Distribution Grid, anti-islanding schemes and challenges, etc.

The course also introduces a series of new trends in Smart Distribution and ADMS development, on-grid energy storage related technologies, transportation electrification, resilient fault isolation and service restoration approaches without relying on communications, etc.

**TUT-11 VALUING DISTRIBUTED ENERGY RESOURCES as NON-WIRES ALTERNATIVES**
8:00am – 5:00pm

**Presenters:**
Ralph Mascolo, Quanta Technology
Shay Bahramirad, ComEd
Farzan Farzan, Quanta Technology
Amin Khodaei, University of Denver
Eli Ntakiou, Quanta Technology
Aleksi Paaso, ComEd
Richard Tabors, TCR

This tutorial will cover the problem of evaluating DER as NWA. It includes a survey of state initiatives and proposed methodologies. A formulation of the problem as an engineering-economics framework is presented leading to the concept of the Locational Marginal Value of DER. Examples are presented including how to evaluate particular DER technologies. The issues of integrating Non-Wires Alternatives into the distribution system planning process are covered. The concept of placing the value of the grid and the value of DER on an applies to applies basis in a cost-benefit framework is described.

**TUT-12 RECENT ADVANCES IN MICROGRIDS OPERATION and CONTROL**
8:00am – 5:00pm

**Presenters:**
Marc Carbone, NASA
Joseph Guarnieri, Aalborg University
Claudio Cañizares, University of Waterloo
Kenneth Loparo, Case Western Reserve University
Robert H. Lasserter, University of Wisconsin-Madison
Rob Hovsapian, NREL
Ali Mehrizi-Sani, VirginiaTech

The increasing global focus on our electric power infrastructure indicates that microgrids will play an important role in creating a more reliable energy grid. Microgrids are a group of connected loads and Distributed Energy Resources (DERs) with clearly defined electrical boundaries. Advanced controls techniques allow this class of electric power systems to operate in both grid-connected and islanded mode. Benefits of microgrids include improved reliability, higher power quality, more diverse energy sources and greater resiliency. This tutorial will introduce the recent technological advances within context of microgrids and their planning, operation and control.

**TUT-13 UNDERSTANDING TRANSIENT RECOVERY VOLTAGES and THEIR MEASUREMENT in SUBSTATIONS**
8:00am – 5:00pm

**Presenters:**
David Peelo, DF Peelo & Associates
Farnoosh Rahmatian, NuGrid Power Corp

Transient recovery voltages (TRVs) are the voltages imposed on circuit breakers immediately after current interruption. The principal cases of interest are the interruption of the currents associated with terminal faults, short line faults and out-of-phase switching, and breaking capacitive and inductive load currents. During this tutorial each case will be discussed in detail explaining the origin and derivation of the attributes associated with the TRVs including pole factors, amplitude factors, two- and four parameter representations and traveling waves where applicable. Instrumentation for field measurement of TRVs will be discussed. Practical field issues such as sensor size and location, and the challenge of using electric sensors that effectively change the circuit under test will be discussed. Use of optical voltage and current measurement techniques for “non-intrusive” measurement will be discussed in detail. Attendees should bring a hand calculator to the class.

**TUT-03 AN INTRODUCTION TO DIGITAL SWITCHGEAR**
1:00pm – 5:00pm

**Presenters:**
Harsh Karandikar, ABB Inc.
Ron Pate, ABB Inc.
Edgar Flores, ABB Inc.

Medium voltage (MV) switchgear is a key element of the electrical energy distribution system. The digital switchgear concept, at the MV distribution level, presents many operational advantages and is inherently safe. It is based on the combination of technologies such as current and voltage sensors and IEC 61850 incorporated into modern numerical IEDs. When these technologies are combined in an optimal way the advantages of digital switchgear include increased safety, space, weight and energy savings, flexibility towards changing load flows, the ability to more easily handle last minute load changes, quicker delivery times and the possibility of late customization. This tutorial will cover the background and characteristics of digital switchgear and contrast it with conventional switchgear. Two key component technologies, current and voltage sensors and IEC 61850 based protection and control, will be covered in detail. The practical experiences gained from the early projects in the field will be presented.
TUT-06
GROUNDING DESIGN AND ANALYSIS FOR PERSONNEL SAFETY IN WIND AND SOLAR POWER PLANTS
1:00pm – 5:00pm
Presenters:
Loren Powers, DNV GL
Robert Schaefer, P.E., POWER Engineers, Inc.
Gopal Padmanabhan, RES Americas
Abdou Sana, RES Americas

Wind and PV solar power plants present vastly different grounding requirements from that of a traditional power plant or a substation. Much of these challenges have to do with the large area covered by the plants, but also with the varying soil and fault conditions over this area. As the IEEE Wind and Solar Plant Collector Design Working Group is finalizing new IEEE guides on wind (IEEE Std P2760) and solar (IEEE Std P2778), power plant grounding design and analysis, we look to share recommended approaches with individuals designing these facilities or analyzing their grounding systems. Half of this tutorial will present the key aspects regarding wind power plant grounding, while the other half will focus on solar power plant grounding. Each will include a presentation of a sample project and the steps taken in the design and analysis process.

TUT-10
DISTRIBUTED ENERGY RESOURCE (DER) INTERCONNECTION STUDIES CONSIDERING IEEE 1547-2018 STANDARD
1:00pm – 5:00pm
Presenters:
Sridhar Chouhan, PhD, P.E., Leidos Engineering
Trisha Swayne, P.E., Leidos Engineering
Dilawar Tewari, P.E., Leidos Engineering

Distributed Energy Resource (DER) interconnection studies determine potential issues and identify mitigation strategies that allow for successful integration. This tutorial will provide an overview of different approaches used by electric utilities across the U.S. and Caribbean to perform DER technical merits over isolated solar projects. A case study will be presented specific to a distribution level solar plus storage interconnection studied using the new IEEE 1547-2018 standard to show study steps, mitigation strategies and lessons learned. The transmission-level interconnection study process will be demonstrated through a case study of a solar interconnection following applicable standards and NERC guidelines. A case study will be presented specific to a distribution level solar plus storage interconnection studied using the new IEEE 1547-2018 standard to show study steps, mitigation strategies and lessons learned. A case study of a solar interconnection following applicable standards and NERC guidelines will be provided.

FIELD MUSEUM OF NATURAL HISTORY
6:00pm – 9:00pm
Join us for an unforgettable evening in one of Chicago's preeminent halls of discovery and science—the historic Field Museum of Natural History.

TUT-02
S&CELECTRIC COMPANY FACTORY TOUR
7:30am – 12:30pm
Cost: $25
Capacity: 40
Join us on a tour of S&C’s Chicago Industrial Campus, which is the home of its corporate headquarters, design, production and testing facilities. This tour will feature a look at the Advanced Technology Center (ATC), including the Nicholas J. Conrad Laboratory. The laboratory is the largest manufacturer-owned short-circuit testing laboratory in North and South America and includes two 850 MW electrical short-circuit test generators that can test up to 100 kA and up to 230 kV. The laboratory is used for production testing as well as contract testing for the region. The tour also includes a Smart Grid demonstration and a plant walk through.

TT-04
CRRC SIFANG AMERICA RAILCAR ASSEMBLY FACILITY TOUR
12:00pm – 4:00pm
Cost: $25
Capacity: 40
Railcar manufacturing is back in Chicago after some 50 years. Production on the new 7000 Series railcars for the Chicago Transit Authority recently got under way at Chicago’s southeast side. Join us on a tour of CRRC SIFANG America’s brand new state-of-the-art manufacturing facility that was built after the company was awarded the CTA contract in 2016. The 380,000-square-foot facility has stations for each stage of production, such as assembly, weighing and water testing. One station is set up to replicate the dimensions of the narrowest places CTA trains navigate.

IEEE LEADING TECHNICAL TEAMS WORKSHOP
8:30am – 4:30pm
Join IEEE for a dynamic new course for managers, directors and executives that will increase your team effectiveness, inspire collaboration and enhance your leadership capability.

The training will have a specific focus on the unique skills needed to lead technical talent and you will receive a 360-degree view of your leadership skills and leave the course with a development plan for targeted improvement in leading teams.

CONSIDERING IEEE 1547-2018 (DER) INTERCONNECTION STUDIES
This course will provide a fundamental foundation in electric power systems, from basic formulas to the planning, operations and equipment involved in generating, transmitting and distributing electric power. Basic electrical terminology will be explained in simple to understand language with regard to design, construction, operation and maintenance of power plants, substations, and transmission and distribution lines. Anyone who is involved in some way with the electric utility industry will benefit from attending this course.

Each day begins at 7:30am with continental breakfast and registration. These courses are eligible for CEU/PDH credit. Plain Talk registrants will also be provided with a complimentary exhibit floor pass for Thursday, April 23. Registration to the T&D Conference is not required.

To register, please visit: https://event-wizard.com/
PlainTalkTnDApr2020/0/welcome/

POWER SYSTEM BASICS:
UNDERSTANDING HOW THE BULK ELECTRIC POWER SYSTEM WORKS
7:30am – 5:00pm
Included with this course:
• 0.6 CEUs / 6 PDHs
• Personal profile with a custom action plan
• Peer coach
• Breakfast, lunch and breaks with networking opportunities
• Special IEEE Member pricing

You do not need to be registered for the T&D conference or be an IEEE member to attend! All technical team leaders are welcome.

The cost is $450 per person. IEEE Member price is $395. REGISTRATION CLOSES MARCH 16.
Seating is limited.

Register now: https://event-wizard.com/
IEEELeadTechTns/0/welcome/

TECHNICAL TOURS

TT-03
COMED TECH CENTER LAB
8:00am – 12:00pm
Cost: $25
Capacity: 40
Opened in 2019, the Forensics Lab was designed to help ComEd evaluate material failures that caused outages or disturbances, refine the equipment that helps ComEd evaluate material failures, and test new technologies to improve their grounding systems. The lab is designed to test and evaluate the latest in technologies and materials used in the field.

TT-04
SUZLON WIND TURBINE TRAINING CENTER TOUR
8:00am – 1:00pm
Cost: $25
Capacity: 40
Join us on a tour of Suzlon’s Wind Turbine Training Center in Egin, Illinois. The Wind Turbine Training Center opened in October 2011 and provides educational and training support to technicians in the North and South American markets. The training center features a fully operational 2.1MW wind turbine nacelle–North America’s first fully operational wind turbine dedicated to training. The nacelle is mounted on an eight-foot tower supported by down tower control and power panels.

TUP-05
IEEE LEADING TECHNICAL TEAMS WORKSHOP
8:30am – 4:30pm
Join IEEE for a dynamic new course for managers, directors and executives that will increase your team effectiveness, inspire collaboration and enhance your leadership capability.

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IEEELeadTechTns/0/welcome/

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OPENING SESSION

THE POWER TO TRANSFORM THE PLANET: ELECTRIFYING THE CLIMATE CHANGE CONVERSATION
8:30am - 10:00am

Keynote Speaker:
Christiana Figueres, Former Executive Secretary of the United Nations Framework Convention on Climate Change (UNFCCC) 2010-2016

You will not want to miss this year’s Opening Session. The T&D Conference brings thought and action leaders from across the world to learn about, discuss and collaborate on the most innovative technologies in the industry, but this is where you will see how all the pieces link together to form a broader vision. When we talk about Electrifying the Future, what we mean is leveraging technologies to help communities make informed decisions to enhance their lives. Because ultimately this isn’t about the latest grid equipment or new research; it’s about how to use these innovations to make the whole electric grid and the neighborhoods that rely upon them, more reliable, more resilient and more sustainable.

It all begins with the ClimateMusic Project, an extraordinary collaboration of artists and scientists who create and perform music that communicates the urgency we face with the climate crisis. Climate change can seem abstract and difficult to communicate, but this group has figured out innovative ways to use music to make the science comprehensible. News organizations from Verge to the New York Times have described the impact of their work and how it can help drive listeners to act.

Following the performance Christiana Figueres, the keynote speaker, will build off of her experience leading the negotiation for the Paris Climate Accords to tell the story of not just how we got here, but where we could be going. Figueres is one of the most important diplomats in the world, representing her native Costa Rica across Europe, and then becoming the Director of the Technical Secretariat of the Renewable Energy of the Americas program, and founded and directed the Center for Sustainable Development in the Americas. This was the foundation that she used to bring together the leading countries in the world to perhaps the most significant agreement ever, to not just acknowledge the reality of climate change, but meet it. This experience hasn't just been valuable to governments; she’s also the Principal Climate Change Advisor to ENDESA Latinoamérica, the largest private utility in Latin America, a reminder that understanding the broader picture matters for policy makers and industry leaders alike.

Concluding the Opening Session, host utility ComEd’s CEO Joe Dominguez will discuss the role utilities and the energy sector will play in impacting climate change. As a strategic leader of critical energy policy who is passionate about elevating the need to combat the climate crisis, Dominguez leverages his experience in leading energy policies to make communities more resilient and sustainable.

SUPER SESSION

SS01 ENGINEER OF THE FUTURE
3:30pm - 5:30pm

Moderator:
Tom Hulsebosch, Sr. Managing Director, Energy and Utility Practice Lead, West Monroe Partners

Panelists:
Terence Donnelley, President & COO, ComEd
Steve Woerner, President & COO, BGE
Math Bollen, Professor Electric Powering Engineer, Lulea University of Technology
Douglas Proudfoot, VP, Advisory Services at Quanta Technology
Erin Inman, President & CEO, Primera Engineers

Emerging technologies are not just transforming the energy industry, they’re also calling for new skillsets in the workforce that leverages them. This session will feature a discussion from leading industry speakers on what the engineer of the future looks like, what skills are needed for engineers to succeed, and the steps industry leaders can take to ensure our engineers are prepared for the future.

PANEL SESSIONS

PS5 ADVANCED COMPUTATIONAL METHODS AND TOOLS FOR POWER SYSTEM RESILIENCE ANALYSIS
10:15am – 12:15pm

Moderator:
Feng Gao, ANL

Panelists:
Emanuel Bernabeu, PJM
Marianna Vaiman, V&R Energy
Rui Yao, Argonne National Laboratory
Liu (Calvin) Zhang, ComEd
Nan Duan, Lawrence Livermore National Laboratory
Due to the challenges of natural disasters, growing system loading levels and increasing penetration of variable generation resources in the power system, power system resilience is more and more important. The resilience assessment and decision support pose various challenges in terms of interdependency, computational efficiency and scalability, uncertainty quantification, etc. This panel session will introduce novel computation methods and tools for resilience analysis and discuss how they can be utilized into the system operations and planning for routine resilience analysis.

Moderator: Abder Elandaloussi, Burns & McDonnell
Panellists:
- Doug Houseman, Burns & McDonnell
- Paul Gogan, WEC Energy Group
- Dana Cabbell, Southern California Edison
- Mark Hegerle, Southern California Edison

Innovation is born out of experimentation. Once an organization taps into the potential of resources at its disposal and experiments with different combinations of those resources, it can uncover the true secret to growth and prosperity. The electric sector overall has been experiencing innovation at an exponential rate to adapt to the ever-changing environment in which it operates. In addition, many utilities have set internal visions and strategies as a proactive measure to prepare for whatever other changes they may face. This panel session will shed light on how various stakeholders within the electric sector are addressing innovation and contributing to achieving the overarching vision of the electric sector: preparing the electric grid for what is coming around the corner. This panel will bring together innovation strategists from across the country to share their views on success stories, opportunities and challenges that they have experienced related to promoting and sustaining innovation. They will discuss what resources they leveraged and combined together as part of innovation.

Moderator: Yu Liu, Shanghai Tech University
Panellists:
- Sakis Meliopoulos, Georgia Institute of Technology
- Ali Albu, Northeastern University
- Zhenyu Tan, Google Brain
- Yuzhang Lin, University of Massachusetts, Lowell

Modern power systems are evolving with an increasing penetration of power electronic-interfaced devices, resulting in complex, fast and unusual power system dynamics that many times adversely affect system protection. On the other hand, the power systems are equipped with more state-of-the-art measurement sensors that can provide synchrophasor measurements from PMUs and instantaneous “points on wave” measurements from Merging Units, with high accuracy. These facts bring challenges as well as opportunities for improving power system resiliency. This panel session will discuss new model-and measurement-based approaches for power system operational resiliency and demonstrate their practical applicability from different perspectives, including monitoring, protection, control, cyber security, model calibration and power restoration.

Moderator: Dongbo Zhao, ANL
Panellists:
- Yuting Tian, Argonne National Laboratory
- Vladimir Kortorov, Argonne National Laboratory
- Joydeep Mitra, Michigan State University
- John Fu, Eaton Corporation
- Lina He, University of Illinois at Chicago

The deployment of energy storage systems is gaining significant momentum due to economic incentives, power system regulation requirements and integration of renewable energy sources. Energy storage devices and certain types of flexible loads can be considered as the component that mediates between energy generation and consumption which will benefit both the transmission and distribution systems. This panel session examines the state-of-the-art grid scale energy storage related topics, including modern storage facilities, advanced modeling approaches in planning and operation stages, and lessons learned from the real-world energy storage management and operation. The discussion will cover the modeling and techno-economic analysis for pumped storage hydro, testing and cycling behaviors of battery energy storage, and the reliability and resilience impacts, challenges and future research directions of energy storage and flexible loads in the power grid.

Moderator: Zhaoyu Wang, Iowa State University
Panellists:
- Nanpeng Yu, UC Riverside
- Feng Qiu, Argonne National Lab
- Yinchen Zhang, National Renewable Energy Lab
- Matthew Reno, Sandia National Laboratories

Recent years have seen great advances in sensor technologies and their implementation in power systems, such as PMUs, microPMUs, SCADA and smart meters. These measurement devices have produced many datasets at different timescales in various locations. This large amount of data offers new opportunities to leverage machine learning to reveal unknown power system characteristics and improve power system situational awareness, operation and resilience. However, there are many outstanding challenges, such as obtaining big datasets for learning, certifying learning performance, interpreting learning process and convincing power engineers on learning results. This panel session will discuss the fundamentals, challenges, new machine learning and data analytic technologies, and application cases in analyzing real utility data by bringing perspectives from academia, research labs and industry.

Moderator: Manuel Avendano, Southern California Edison
Panellists:
- Katie Sloan, SCE
- Daniel Kushner, ComEd
- Scott Samuelsen, UCI
- Charlie Smith, ESIG

Increasing expert consensus shows that electrification of energy use and ends will be crucial to reach carbon-emission goals and mitigate climate change. A holistic view is required to combine energy carriers with infrastructures, such as transportation, water and data networks, to achieve sustainable decarbonization based on the integration of energy systems. In this panel session researchers and industry professionals will provide insights into how electrification can help other sectors and consumers decarbonize in the context of a rapidly evolving, digital world. The discussion will include broad-perspective and case studies covering such topics as frameworks for utility-driven and policy-based electrification, grid scenarios for reducing greenhouse gas emissions, and the electrification of end-use services in the transportation, building and industrial sectors. The panel will focus on advanced concepts, technologies and practices associated with electrification in a decarbonized future from a technical perspective, as well as on how to address business, environmental and social concerns.

Moderator: Jason Ball, Washington Utilities and Transportation Commission
Panellists:
- Ahlmahz Negash, Tacoma Power
- Uzma Siddiqi, Seattle City Light
- John Hieb, Snohomish County PUD
- Erik Gilbert, Navigant Consulting
- Jens Nedrud, Puget Sound Energy
- Jason Ball, Washington Utilities and Transportation Commission

Non-wires alternatives (NWAs) are solutions that can address transmission and distribution system needs while deferring or replacing traditional poles and wires projects. Electric utilities are exploring and implementing NWAs for a variety of reasons including opportunity to reduce investment costs, regulatory requirements, customer expectations, and desire to keep pace with rapidly changing technologies and industry practices. Incorporating NWA analysis into utility practice requires a broad array of functional groups from across a utility. The analysis efforts that have begun at utilities around the Pacific Northwest reflect interdisciplinary nature. This panel session will include input from each of these varied functional perspectives and will discuss new NWA topics including motivation for pursuing NWAs, progress and experience to date, and key next steps planned. The intended outcome of this panel is for attendees to appreciate the necessity for cross-functional coordination and be better prepared for NWA efforts in their own organizations.

Moderator: Yinchen Zhang, National Renewable Energy Lab
Panellists:
- Vlad Kumin, Argonne National Laboratory
- Nanpeng Yu, UC Riverside
- Feng Qiu, Argonne National Lab
- Yinchen Zhang, National Renewable Energy Lab
- Mathew Reno, Sandia National Laboratories

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Moderator: Charlie Smith, ESIG
Panellists:
- Katie Sloan, SCE
- Daniel Kushner, ComEd
- Scott Samuelsen, UCI
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Moderator: Charlie Smith, ESIG
Panellists:
- Katie Sloan, SCE
- Daniel Kushner, ComEd
- Scott Samuelsen, UCI
- Charlie Smith, ESIG
This panel introduces MH into the RO solution in the worst case from a standpoint of risk that make use of RO to evaluate the optimal solution that is still feasible in the worst case. To overcome that, there are alternative methods to the traditional RO. For instance, the robust optimization (RO) can be used to address the problem of uncertainty in the parameters of the system. The RO problem is formulated as a two-stage stochastic optimization problem, where the first stage is the decision made before the realization of the uncertain parameters and the second stage is the decision made after the realization of the uncertain parameters. The objective of the RO problem is to find a feasible solution that is robust against the uncertainty in the parameters. The RO problem can be solved using a variety of methods, including the scenario-based approach, the sample average approximation, and the trust region method. The scenario-based approach is the most straightforward method, but it requires a large number of scenarios to accurately capture the uncertainty in the parameters. The sample average approximation is a more computationally efficient method, but it relies on the assumption that the uncertainty in the parameters is stationary. The trust region method is a more sophisticated method, but it requires a good understanding of the problem and the uncertainty in the parameters.
PS42
BLOCKCHAIN
1:00pm – 3:00pm
Moderator:
Amin Khodaei, University of Denver
Panelists:
Nayeem Mohammad Abdullah, ComEd
Gerald Gray, EPRI
Michael Mylrea, PNNL
Mohammad Shahidehpour, Illinois Institute of Technology
Blockchain or distributed ledger technology is significantly being considered as a disruptive and revolutionary technology, especially as the utilities work on mitigating the impacts of climate change. While it was initially correlated to financial applications, it has now gained considerable interest in the energy sector. It seems to be poised to provide a fundamental shift in not just the manner the energy platform operates from financial perspective, but also provide value from operations, cybersecurity and customer interaction dimensions. This panel will focus on different use cases of blockchain in the energy sector, especially focusing on DER enablement, energy transactions, interactive prosumer based grid and cybersecurity. This panel will also focus methods of demonstrating this technology, challenges in implementation, and discuss some of the ongoing pilots across the industry.

PS43
FROM STEM TO POWER ENGINEER
1:00pm – 3:00pm
Moderator:
William Hanigan, ComEd
Panelists:
Jason Coleman, Co-founder and Executive Director of Project Syncere
John Brophy, City Colleges of Chicago
Shay Bahramirad, ComEd
Jeanne Century, University of Chicago
This STEM education panel will include representation from the Leadership Lab, Academic experts, expert engineers in the field and the manager of ComEd’s Smart Grid STEM Programs to discuss the importance of early exposure to STEM concepts and skills from every angle of the industry. Exploring how we can build an innovative future through STEM education involves studying the impact of these programs on students, on the energy industry, and on the world. This panel will discuss the skills needed to drive technological change, the different ways we can ensure equality of opportunity for all students in STEM skills, and what these programs do to strengthen the community holistically.

PAPER FORUM SESSIONS
FORUM 1
POWER SYSTEMS OPERATIONS, PLANNING AND ECONOMICS
10:15am – 12:15pm
Papers and Authors:
2020TD0136: A Framework to Quantify the Value of Operational Resilience for Electric Power Distribution Systems
Mansir Mukherjee, Washington State University
Shiva Poudel, Washington State University
Anamika Dubey, Washington State University
Anjan Bose, Washington State University
Miladjavadi, Lower Colorado River Authority
Kristian M. Koellner, Lower Colorado River Authority
Di Wu, North Dakota State University
Gangan Li, University of Oklahoma
Guomin Ji, University of Oklahoma
John N. Jiang, University of Oklahoma
2020TD0204: The Impact of Grid Code Requirements on Efficient Wind Generation Integration
Sarat Chandra Vagunta, S&C Electric Company
Xiaoqiang Xu, S&C Electric Company
Martin Bishop, S&C Electric Company
Saeed Kamalnia, S&C Electric Company
2020TD0243: Use of PMU-Based Software Platform to Provide Real-Time Situational Awareness for Bronzeville Community Microgrid
Niroj Gurung, ComEd
Sri Raghavan (Raghu) Kothandaraman, ComEd
Liuxi (Calvin) Zhang, ComEd
Heng (Kevin) Chen, ComEd
Farnoorah Rahmatian, NuGrid Power
Michael Y. Vaiman, V&R Energy
Mariana M. Vaiman, V&R Energy
Mark Povolotskiy, V&R Energy
Mikhail Karpoukhin, V&R Energy
2020TD0290: Distribution System Enabled Energy Transactions and Clearing Among Clustered Microgrids
Khaleel Alothali, ComEd
F. Salin Yankara, ComEd
Nayeem Abdullah, ComEd
2020TD0218: Market-Based Co-optimization of Energy and Ancillary Services with Distributed Energy Resource Flexibilities
Kia Ma, Pacific Northwest National Laboratory
Daxin Wang, Pacific Northwest National Laboratory
Janning Liu, Pacific Northwest National Laboratory
Di Wu, Pacific Northwest National Laboratory
Srinivas Katipamula, Pacific Northwest National Laboratory
Tamar Schriek, Institute of Electric Power Systems
André Richter, Institute of Electric Power Systems
Martin Wolfer, Institute of Electric Power Systems
Jenny Gronau, ST6Hertz Transmission GmbH
Andre Naumann, Energy Systems and Components
2020TD0228: Dynamic Control of Volt-VAR Control Devices: An Effective Approach to Overcome Associated Issues with High Penetration of Solar Photovoltaic Resources
Kaveh Rahimi, Varentac
Hong Chun, Varentac
Rohit Moghe, Varentac
Damian Tholomier, Varentac
Frankie Wong, Hawaiian Electric
Alan Hirayama, Hawaiian Electric
Marc Asano, Hawaiian Electric
2020TD0280: Overvoltage Mitigation through Volt-VAR Control of Distributed PV Systems
Qingxin Shi, University of Tennessee
Wei Feng, University of Tennessee
Qiwei Zhang, University of Tennessee
Xiaoxi Wang, University of Tennessee
Fangxing Li, University of Tennessee
2020TD0301: Impacts of PV Capacity Allocation Methods on Distribution Planning Studies
Asmaa Arshouh, North Carolina State University
Ning Lu, North Carolina State University
2020TD0311: A Study of Imbalance Levels Associated to Photovoltaic Penetration in Distribution Systems
Zachary Minter, Drexel University
Jesse Hill, Drexel University
Jauldebe de Oliveira, Drexel University
Karen Mu, Drexel University
Steven Hughes, PPL Electric Utilities
2020TD0361: Using an Advanced Distribution Management System Test Bed to Evaluate the Impact of Model Quality on Volt/VAR Optimization
Annabella Pratt, National Renewable Energy Laboratory
Ismael Mendosa, National Renewable Energy Laboratory
Muhammad Usman Usman, National Renewable Energy Laboratory
Soumya Tiwari, National Renewable Energy Laboratory
Harsha Pudulpatti, National Renewable Energy Laboratory
Murali Baggu, National Renewable Energy Laboratory
Eric Lightner, Department of Energy
FORUM 2
POWER SYSTEMS RELAY AND PROTECTION, COMMUNICATIONS AND CYBER SECURITY
1:00pm – 3:00pm
Papers and Authors:
2020TD0013: Design and Implementation of an IEC 61850 GOOSE-Based Protection Scheme for an Islanded Power System
Michael Higginson, S&C Electric Company
2020TD0138: Analysis of the Experimental Results of the Traveling-Wave Fault Location in Tree-like Hybrid Distribution Network
Rustem Khuzayshev, Kazan State Power Engineering University
Igor Kuzmin, Kazan State Power Engineering University
Samat Tukaev, Kazan State Power Engineering University
2020TD0178: Study and Investigation of Transformer Turn-to-Turn Winding Faults Using Park’s Vector
Hemanth Kumar Vempala, Michigan Technological University
Md Aamin Rahmani, Michigan Technological University
Bruce Andrew Monk, Michigan Technological University
2020TD0223: Multi-Stage Protection Coordination Optimization for Distribution Systems with Topology Changes
Khaled Sali, Natural Resources Canada
Ali Mehrizi-Sani, Natural Resources Canada
2020TD0297: Protection Challenges for the Changing Electrical Grid
Ashok Gopalakrishnan, Siemens PTI
2020TD0201: Substation Automation Systems: A Numeric Approach
Bamdad Falahati, SEL
Masood Shahverdi, California State University
Poria Faji, University of Nevada, Reno
Amin Kargarani, Louisiana State University
2020TD0229: A Systematic Approach to Light Load Calculation for DG Unintentional Islanding
Le Chen, University of Tennessee
Joseph Saylor, Dominion Energy
Aaron Clark, Dominion Energy
Jiecheng Zhao, Dominion Energy
Francisco Velasquez, Dominion Energy
Hesen Liu, University of Tennessee
Yiu Liu, Oak Ridge National Laboratory
Enjoy lunch served to you in the exhibitor hall while exploring real-world applications and the emerging technology and product solutions key to our industry’s future success.

**SOLAR TOUR**

**JOHN G. SHEDD AQUARIUM ROOFTOP**

- Capacity: 20
- Cost: $25
- Time: 12:30pm – 3:30pm

CTE tours can be engaged, the challenges, identify opportunities and test solutions. The Community of the Future provides a safe environment to learn how to gather inputs and ideas from new sources, explore new technologies and foster new relationships to innovate. Community input is solicited to understand priorities that guide the assessment, review and selection of projects that offer promise to achieve the objectives. The tour will highlight several projects underway including but not limited to:
  - CSMART (Center for Smart Grid Applications, Research, and Technology) Lab at Illinois Tech
  - Battery Energy Storage System (BESS) for Bronzeville Microgrid
  - Smart Kiosk
  - Off-Grid Lighting at Dunbar High School
  - Chicago Housing at Dearborn Homes Authority Solar Installation for Bronzeville Microgrid

**TECHNICAL TOURS**

**TT-05**

**G&W ELECTRIC COMPANY FACTORY TOUR**

- Capacity: 40
- Cost: $25
- Time: 8:30am – 1:30pm

Join us on a tour of G&W’s corporate headquarters in Bolingbrook, Illinois, which is home to design, production and testing facilities.

**TT-06**

**COMMUNITY OF THE FUTURE TOUR**

- Capacity: 20
- Cost: $25
- Time: 9:30am – 12:30pm

ComEd initiated a smart city test bed in February 2016 calling it the “Community of the Future” to engage the community of Bronzeville, understand its challenges, identify opportunities and test solutions. The Community of the Future provides a safe environment to learn how to gather inputs and ideas from new sources, explore new technologies and foster new relationships to innovate. Community input is solicited to understand priorities that guide the assessment, review and selection of projects that offer promise to achieve the objectives. The tour will highlight several projects underway including but not limited to:
  - CSMART (Center for Smart Grid Applications, Research, and Technology) Lab at Illinois Tech
  - Battery Energy Storage System (BESS) for Bronzeville Microgrid
  - Smart Kiosk
  - Off-Grid Lighting at Dunbar High School
  - Chicago Housing at Dearborn Homes Authority Solar Installation for Bronzeville Microgrid

**TT-07**

**JOHN G. SHEDD AQUARIUM ROOFTOP SOLAR TOUR**

- Capacity: 20
- Cost: $25
- Time: 12:30pm – 3:30pm

Enjoy lunch served to you in the exhibitor hall while exploring real-world applications and the emerging technology and product solutions key to our industry’s future success.

**CONFERENCE LUNCHEON**

Enjoy lunch served to you in the exhibitor hall while exploring real-world applications and the emerging technology and product solutions key to our industry’s future success.
The Chicago Architecture Center is a leading non-profit cultural organization that informs the local and global discussion about how design affects the cities and world in which we live. This year, it will host a cutting-edge exhibit that will inform technical and general audiences about how cities could be developed to mitigate and adapt to climate change. During this tour, attendees will see an exhibit that asks three key questions on energy: What needs to change? Why should we change? How will we live in the future? This exhibit will not only ask provocative questions but provide perspective from both global and local thinkers from the design world about some potential answers. It offers interactive experiences in which attendees will be able to think through how different decisions made today could lead to dramatically different outcomes. Finally, it will leverage real-world experiences to sketch some potential futures, highlighting some of the significant advances occurring in Chicago, particularly in the Bronzeville neighborhood on the South Side of Chicago, where a unique utility-city coalition is developing and demonstrating technologies that make not just the grid, but communities more sustainable and resilient.

**INNOVATION STAGES**

**INNOVATION IN THE ELECTRIC UTILITY INDUSTRY AND THE IEEE PES INNOVATIVE SMART GRID TECHNOLOGIES (ISGT) CONFERENCE** 10:15am - 11:15am  
**Presenter:** Julio Romero Agüero, Quanta Technology  
The electric utility industry is experiencing an unprecedented transformation driven by the evolving expectations of customers and society, the emergence of new challenges such as climate change, the introduction of new business models and market participants, and the adoption of emerging technologies. Utilities are increasingly focusing on innovation as a means to develop new products, services and solutions to address customer needs, identify new business opportunities and partners, improve operational efficiency, and remain relevant in this growingly competitive and dynamic world. This session will discuss industry experiences regarding the development and implementation of innovation strategies, as well as key trends, challenges, solutions, lessons learned and examples of industry activities and success stories in this area. This presentation will also discuss the role of the Innovative Smart Grid Technologies (ISGT) Conference as a key event sponsored by the IEEE Power and Energy Society (PES) for sharing experiences and industry practices in this area.  
**Supported by Quanta Technology**

**STRENGTHEN WEAK GRIDS USING HYBRID SYNCHRONOUS CONDENSERS** 11:15am - 12:15pm  
**Presenter:** Anders Stiger, ABB Inc.  
With the big changes in the network due to a higher share of solar and wind generation (power electronic-based generation), the traditional power plants’ contribution of inertia and short circuit current is going down. This makes the network weaker and more susceptible to disturbance. In some way the network needs to compensate for lost inertia and reduce short circuit level to assure a reliable operation. A smart setup of synchronous condensers, in conjunction with SVCs (Static Var Compensators) or STATCOMs (Static Synchronous Compensators), will provide fast response reactive power and voltage control, together with increased system inertia and increased short circuit level. This presentation will focus on the benefits of combining STATCOMs and synchronous condensers.  
**Supported by ABB Inc.**
SUPER SESSION

SS02 PREPARING FOR ANYTHING: RESILIENT SYSTEM DESIGN
8:00am – 10:00am
Moderator: Darcy Immerman, Senior Vice President, Resiliency, AECOM
Panelists: Shay Bahramirad, VP, Engineering and Smart Grid, ComEd
John Moura, Director of Reliability Assessments and Performance Analysis, NERC
Aftab Khan, SVP of Engineering, Eversource Energy
Colton Ching, SVP, Planning & Technology, Hawaiian Electric

How do we define resiliency? An in-depth discussion surrounding global outages in recent years and how we can move toward an electrical system that is prepared for anything. How do distributed energy resources impact resiliency? What will a resilient system look like moving forward?

PS3 SECURELY AND RELIABLY LEVERAGING CLOUD COMPUTING FOR GRID OPERATION, PLANNING, CONTROL AND IOT
1:00pm – 3:00pm
Moderator: Song Zhang, ISO NE
Panelists: Feng Qiu, ANL
Pavel Etingov, PNNL
Yingmeng Xiang, Geirina
Casey Werth, IBM

Cloud computing technology has become mature and highly commercialized in the past decade. It is now a critical infrastructure as vital as power, gas and fresh water supply. However, the power industry is reluctant to adopt it due to common concerns over cyber security and lack of understanding of this state-of-the-art technology. Ironically, many business sectors that are deeply involved with cloud computing, such as healthcare, finance, insurance and e-commerce, have no less rigid requirements on cyber security than the power industry. A recent technical conference held by FERC on June 27, 2019 has extensive discussions upon the use of cloud services in utilities. The conference releases an important signal to encourage the secure and reliable adoption of cloud technologies. To help the entire power and energy society build confidence on using cloud services, it is necessary to address its concerns and bridge the gap between its understanding and that of cloud technology insiders. The objective of this panel session is to bring together sporadic cloud users in power industry, cloud service providers/partners, energy regulating bodies and other related entities to share experiences including success stories and lessons learned, exchange opinions about how to address security and privacy concerns on the cloud, and discuss the future work direction of promoting cloud computing application in power systems.

PS4 PREDICTIVE ANALYTICS FOR POWER SYSTEMS DECISION-MAKING AND CONTROL
1:00pm – 3:00pm
Moderator: YC Zhang, National Renewable Energy Laboratory
Panelists: Kevin Chen, ComEd
Power Zhao, Oncor
Ron Melton, PNNL
Vassilis Kekatos, Virginia Tech
Ram Rajagopal, Stanford

The development and deployment of new sensing and monitoring capabilities in electric power systems has dramatically increased the amount of heterogeneous data available for power system operators, from sources such as phasor measurement units (PMUs), smart meter-based advanced metering infrastructure (AMI), distributed energy resources (DERs) and home energy management systems. These enormous volumes of data are often at finer geographic and temporal scales than power system operators are used to handling. Being able to collect, curate and create actionable information with this data will be crucial to power systems operations. This panel session will discuss recent developments in advanced data analytics for power systems decision-making.
PS8
GRID EDGE MEASUREMENTS TO IMPROVE DISTRIBUTION SYSTEM MODELING AND ANALYSIS
1:00pm - 3:00pm
Moderator: Matthew Reno, Sandia National Laboratories
Panelists: Jouni Peppanen, EPRI
Yingchen Zhang, NREL
Nanpeng Yu, University of California, Riverside
Francis Therrien, CYME International
Yang Wang, Arizona State University
Logan Blakeley, Sandia National Laboratories
Zhaoyu Wang, Iowa State University
New sensor measurements, such as advanced metering infrastructure (AMI) and distribution phasor measurement unit (PMU), provide an unprecedented level of insight into the distribution system. These measurements from the grid edge provide large quantities of data that can facilitate a variety of use cases. Use cases include model validation/ correction such as phase identification, meter to transformer pairing and topology reconfiguration detection, behind-the-meter analysis such as PV parameter estimation and load disaggregation, control opportunities, and system analysis. Research continues to determine what analysis is possible with grid edge measurements, what the data requirements are for different applications and what concerns there may be, such as privacy, related to the collection of customer data. This panel session will bring together speakers from industry and academia to share their perspectives on the applications of grid edge data and present a selection of state-of-the-art techniques for harnessing the big data from emerging data streams for distribution system modeling and analysis.

PS16
LOCAL ENERGY MANAGEMENT: GRID EDGE FLEXIBILITY AND INCENTIVES
1:00pm - 3:00pm
Moderator: Andrew Kinaci, West Monroe Partners
Panelists: Thomas Chorman, National Grid
Killian Tobin, Omega Grid
Kristen Brown, Edison UK
As DERs proliferate, utilities are developing new strategies to control and influence the behavior of assets at the grid edge. Local Energy Management (also known as transactional energy) is an emerging toolkit that presents new business opportunities associated with grid-edge assets and events. Utilities are experimenting with local energy management approaches and emerging technology in pursuit of four main use cases: DER integration and compensation, reliability and ancillary services; peak demand shaving; and cost reduction and customer choice. This panel session will aim to demonstrate how utilities can design and execute pilot projects using locally flexible strategies. West Monroe will share lessons learned from its research into this growing field and present a case study targeting EV charging transactions at PG&E. The panel will also include utility perspectives from Exelon Utilities and Pacific Gas & Electric, along with vendor perspective from Chicago start-up Omega Grid.

PS28
TRANSACTIONAL ENERGY SYSTEM FOR RESILIENCY IMPROVEMENT
1:00pm - 3:00pm
Moderator: Bishnu Bhattarai, Pacific Northwest National Laboratory
Panelists: Murali Baggu, National Renewable Energy Laboratory
Anuradha Annaswamy, Massachusetts Institute of Technology
Teja Kuruganti, Oak Ridge National Laboratory
Farrokh Rahimi, DAME
Over the past few years, the application of transactional energy systems (TES) during normal grid operations has been explored extensively. However, the application of TES for abnormal grid operating conditions, such as contingencies, has not been explored much. The TES designed for economic operations may not work directly during such contingencies. Quiescent situations because grid contingencies are often driven by the criticality of service.

PS31
DISCUSSION OF NEW DUAL NAMEPLATE kVA FOR DISTRIBUTION TRANSFORMERS
1:00pm - 3:00pm
Moderator: Philip Horvath, Transformers Committee Member
Panelists: Daniil Mulkey, Mulkey Engineering (former PG&E)
Kevin J. Rapp, Cargill, Inc.
Alen Traut, Howard, Inc.
Tom Prevost, BHV Weidmann
Christopher Bouldic, Department of Energy
Steven Rosenfeld, Electric Edison Institute
Robert Ballard, Dutt
Transformer kVA is defined as the amount of output power that can be delivered without exceeding nominal temperature rise. Thermal improvements have led to greater output ratings and smaller physical sizes. However, mandatory energy-efficiency requirements by the US DOE and physical design restraints for smaller units have resulted in designs that are not limited by the rated temperature rise and loading guides have struggled to accurately reflect true capability. Distribution Transformer Loading studies show generally light loading but confused load-ability. New high thermal class fluids and improved solid insulations for liquid-filled transformers coupled with increased electric vehicle charging and greater heat pump use, suggest new dual nameplate ratings for distribution transformers. The base rating would continue to reflect traditional 65°C parameters. The second rating would be the maximum kVA rating based on thermal class of the insulation system. This panel session will discuss the usefulness of the proposed change.

PS36
INTEGRATED GRID AUTOMATION: CURRENT TRENDS AND FUTURE CHALLENGES
1:00pm - 3:00pm
Moderator: Manuel Andrade, Southern California Edison
Panelists: Eric Narula, SCE
Marina Montello, ComEd
Julie Romstad, Quanta Technology
Robert Sherick, Energy Research Co-Operative
Integrated grid automation can improve the speed, cost and accuracy of crucial distribution functions such as feeder switching, voltage and equipment health monitoring, and outage, voltage and reactive power management. This panel session will provide a robust discussion on the reliability improvements and benefits to customers from the deployment of grid automation technologies and systems. The panel will help identify current trends and future challenges in key capabilities improved through grid automation including fault location, isolation and service restoration, distribution system resilience to extreme weather events, equipment monitoring and preventive maintenance, efficient use of repair crews and truck rolls, and grid integration of distributed energy resources (DER).

PS41
VISION FOR THE FUTURE GRID: INDUSTRY PERSPECTIVE
1:00pm - 3:00pm
Moderators: Marianne Vaman, V&R Energy
Sharma Kolluri, Entergy Corporation
Panelists: Shay Baharamirad, ComEd
David Elsundo, Quanta Technology
Chris Heagerty, National Grid
Enrique Tejera, Panama Canal Authority
Babak Enayati, National Grid
The electric grid is currently undergoing major changes mainly due to rapid penetration of renewable generation and retirement of legacy generating units. Therefore, the challenges of maintaining secure, reliable, resilient and stable operation of transmission and distribution systems is becoming equally important. In order to address these challenges, electric utilities are evaluating innovative technologies, exploring new ideas and tools, and adopting new processes and methodologies. The real question is that as an industry, do we really have a right vision and a plan in place to meet the challenges of the evolving grid? In order to address these challenges, electric utilities will share ideas on how to make this program a success. Program, discuss the need and requirements of the Corporate Engagement Program, discuss the need and requirements of the Corporate Engagement Program. ComEd, ISO New England, Quanta Technology and VELCO were the first organizations to join the program in 2019. National Grid joined the program in 2020, and Panama Canal Authority is expected to join in 2020. During this panel session, leaders and experts from these organizations will share their perspective on the Corporate Engagement Program, discuss the need and requirements of the utility industry to meet the future challenges and share ideas on how to make this program a success.
The transportation sector represents a significant fraction of total greenhouse gas (GHG) emissions. As such, transportation electrification is a promising solution to reduce emissions and enable a more sustainable ecological system. Additionally, transportation electrification can offer value on social, consumer and utility fronts with multiple co-benefits. However, there are multi-dimensional barriers and considerations pertaining to the electric grid, tariffs and incentives, amongst others, that must be accounted for in order to successfully transition fleets and drivers to electric vehicles. This panel session will focus on comprehensively addressing these barriers to support effective and streamlined transportation electrification.

**Panelists:**
- Sainab Taiwo Ninalowo, ComEd
- Mohammad Shahidehpour, IIT
- Terence Donnelly, ComEd
- Marina Mondello, ComEd
- Jake Gentle, Idaho National Lab
- Donald MacGregor, Siemens
- Anil Pahwa, Kansas State University
- Babak Enayati, National Grid
- Donald MacGregor, Siemens
- Derrick Zhao, Argonne National Lab
- Anil Pahwa, Kansas State University
- Wanda Reder, GridX Partners
- Donald MacGregor, Siemens
- Wanda Reder, GridX Partners
- Babak Enayati, National Grid
- Wanda Reder, GridX Partners

**Moderator:**
- Dana Al-Qadi, AECOM
PAPER FORUM SESSIONS

FORUM 4
POWER SYSTEM INSTRUMENTATION, MEASUREMENT AND DYNAMIC PERFORMANCE
10:15am – 12:15pm
Papers and Authors:
Inkoor Singh, Electric Power Group
Vikram Chiluka, Electric Power Group
Daniel Trudnowski, Montana Tech
Matt Donnelly, Montana Tech

2020TD0140: Model Reduction of Wind Turbine Generator Models for Control Performance Evaluation
Felipe Wilches-Bernal, Sandra National Labs
Christoph Lackner, Grid Protection Alliance
Joe H. Chow, Renaissance Polytechnic Institute

2020TD0154: Monitoring Large-Scale PV Generation Infeed on Grid Frequency Using Synchrophasor Measurement: Recent Perspective from Kyushu Island
Thongchart Kerdphol, Kyushu Institute of Technology
Yoshiaki Matsukawa, Kyushu Institute of Technology
Masayuki Watanabe, Kyushu Institute of Technology
Yasunori Mitani, Kyushu Institute of Technology

2020TD0233: Partition of Large Power Networks Using a Metaheuristic Optimization Method
Dilini Weerakoon, University of Manitoba
Kalana Dharmapala, University of Manitoba
Thilini Hathiyaldeniye M., University of Manitoba
U. D. Annakkage, University of Manitoba

2020TD0342: A New Fuzzy Logic Based Method for Residential Loads Forecasting
M. Mahal Alam, University of Memphis
Mohd Hasan Ali, University of Memphis

FORUM 5
ENERGY STORAGE, DEVELOPMENT AND GENERATION
1:00pm – 3:00pm
Papers and Authors:
2020TD0077: Efficient Resource Sizing and Placement for Clustered Solar DC Microgrids
Sadib Iqbal, Lahore University of Management Sciences
Hasaan Khan, Lahore University of Management Sciences
Masood Nasir, Lahore University of Management Sciences
Joseph Guerrero, Albion University

2020TD0129: New DER Communications Platform Enables DERMS and Conforms with IEEE 1547-2018 Requirements
Nachum Sadan, GridEdge Networks
Bruce Renz, Renz Consulting

Hanchao Liu, GE Research
Ibrahim Al-Mubarak, GE Research
Yazhou Jiang, GE Research
Xian Guo, GE Research
Ahmed Elasser, GE Research
Martin Yan, GE Research

2020TD0299: DC Collection System Layout Optimization for Offshore Wind Farm
Hamid Tahany, University of Northern Iowa
Sadik Kucukarsi, University of Northern Iowa

2020TD0302: Islanded Distributed Generation Network Using Photovoltaic and Energy Storage Systems for a Small Residential Community
Benito Ramos, Phasor Engineering, LLC
Yaoqi Huang, Florida State University
Vanessa Lopez, Phasor Engineering, LLC

2020TD0156: Testbed for Standardizing the Integration of Utility Grade Battery Energy Storage System
Venkataswaran Lakshminarayanan, NAYAK Corporation
Chathura Patabandi, NAYAK Corporation
Om Nayak, NAYAK Corporation
Amin Salimi, San Diego Gas & Electric Company
Nagadev Shanmukh, San Diego Gas & Electric Company

2020TD0314: Impact of Wide-Area Oscillation Damping Control Using Measurement-Driven Approach on System Separation: Saudi Grid Case Study
Ibrahim Altajamri, University of Tennessee at Knoxville
Lin Zhu, University of Tennessee at Knoxville
Donglin Lu, University of Tennessee at Knoxville
Xianda Deng, University of Tennessee at Knoxville
Evangelos Farantatos, Oak Ridge National Laboratory
Deepak Ramasubramanian, Electric Power Research Institute

2020TD0318: Study of Inverter-Based CHP Unit Requirements
Bruce Renz, Renz Consulting

2020TD0328: A New Form of Battery Energy Storage Systems for Renewable Energy Farms
Hassan Hayajneh, Texas A&M University-Kingsville
Guillermo Meza-Cavazos, Texas A&M University-Kingsville
Xuewei Zhang, Texas A&M University-Kingsville

2020TD0332: Disturbance Resilience Enhancement of Islanded Hybrid Microgrid Under High Penetration of Renewable Energy Resources by BESS
Morteza Daviran Keshavarzi, The University of Memphis
Mohd Ali, The University of Memphis

2020TD0350: Testbed for Standardizing the Integration of Utility Grade Battery Energy Storage System
Venkataswaran Lakshminarayanan, NAYAK Corporation

2020TD0395: Case Study on System Separation: Saudi Grid
Hamid Tahany, University of Northern Iowa
Sadik Kucukarsi, University of Northern Iowa

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Hamid Tahany, University of Northern Iowa
Sadik Kucukarsi, University of Northern Iowa
2020TD017: Modeling and Stability Analysis of Hybrid MTDC Systems with Considering Two Control Methods: Master-Slave Control and Voltage Drop Control
Gyusub Lee, Seoul National University
Saemyoung Hui, Seoul National University
Seungil Moon, Seoul National University
Seunghin Chang, Hanbat National University

2020TD0131: 12kV Covered Conductor Testing
Elyse Pham, Southern California Edison
Richard Bravo, California Institute of Technology
Arianna Luy, Southern California Edison
Jesse Rorabough, Southern California Edison
Eric Hutchinson, Southern California Edison

2020TD0159: Levelized Cost of Energy Calculations for Microgrid-Integrated Solar-Storage Technology
Zoheh S. Hosseini, University of Denver
Amin Khodaei, University of Denver
Shay Bahrami-Nad, ComEd
Liuxi (Calvin) Zhang, ComEd
Aleksi Paaso, ComEd
Mihdlin Lalic, ComEd
Dennis Flinn, ComEd

2020TD0169: Preparation Linear Services Permitting
Benjamin Becker, Black & Veatch
Brian O’Neal, Black & Veatch

2020TD0270: Considering Reliability in the Design of Mixed Overhead and Underground Distribution Feeders
Martin Bishop, S&G Electric Company

2020TD0215: Testbed Demonstration for Distribution Grid Controls with High DER Integration
Prajwal K. Gautam, Southern California Edison
Renée G. Cinar, Southern California Edison
Christopher R. Clarke, Southern California Edison

2020TD0231: Mitigation of Line Outage Rate Due to High Relative Air Humidity
Thair Ibrahim, Hamid Hamid Mustafa, University of Blumenau
Luz Henrique Mayer, University of Blumenau
Hugo Dominguez Almaguer, University of Blumenau
Sergio Luiz, University of Campinas
Leonardo Henrique Bonal, University of Blumenau
Vivian Cesar, CEEE-UNICAMP

2020TD0309: Corrosion Chemical Kinetics in Galvanized Steels
Walter Pinheiro, Tag Inovacao Tecnologica
Simone C N Araujo, Tag Inovacao Tecnologica
Geraldo Roberto de Almeida, Tag Inovacao Tecnologica
Alessandro Pedro Dadam, CELES
Sandro Ricador Leandosk, CELES

PLAIN TALK

TRANSMISSION SYSTEM: THE INTERCONNECTED BULK ELECTRIC SYSTEM
7:30am – 5:00pm

This course will provide knowledge of how electric power is transferred from generation sources to distribution systems via the interconnected electric bulk power system known as “the grid”. Basic physical laws governing the grid will be introduced, as well as the regulatory agencies involved in its governance. The great blackouts, their root causes and lessons learned will also be explored. This course will introduce the understanding of the electric grid and how it functions in the electric power system.

Each day begins at 7:30am with continental breakfast and registration. These courses are eligible for CEU/PDH credit. Plain Talk registrants will also be provided with a complimentary exhibit floor pass for Thursday, April 23. Registration to the T&D Conference is not required.

To register visit https://event-wizard.com/PlainTalkItdApr2020/G/welcome/

TECHNICAL TOURS

TT-09 JOHN G. SHEDD AQUARIUM ROOFTOP SOLAR TOUR
8:00am – 11:30am

Built in 1927 on the south side of Chicago, the John G. Shedd Aquarium is home to 32,000 animals that need a lot of water to swim and thrive. Join us on a tour of the John G. Shedd Aquarium’s rooftop solar facility in Chicago, Illinois. The Shedd Aquarium’s 265-kW rooftop solar installation consists of 913 photovoltaic panels located on the aquarium’s marine mammal pavilion. It is the largest solar installation on any cultural institution in Illinois. The solar system helps power life-support equipment to the aquarium’s Great Lakes gallery. In addition to reducing costs and enhancing the building’s energy reserve and various life support systems, the system supports Shedd’s Great Lakes initiative to protect and preserve the lakes by reducing its reliance on traditional energy sources. Tour attendees will expect to see “behind the scenes” on the Shedd’s solar panel system, along with what goes on for day-to-day Shedd operations.

Cost: $25
Capacity: 20
During this panel session, the many drivers for the growing interest on digital substations are discussed along with the benefits it can bring. The panelists will introduce the main characteristics of IEC 61850 and give practical examples of its different applications for the Protection, Automation, and Control (PAC) of electric power systems. The discussions will address some of the main challenges utilities face when initiating a digital substation program:

- Workforce development: training employees into a new technology.
- Testing: testing aspects of digital substations from the early project design phase through commissioning and subsequent maintenance of the PAC system.
- Cybersecurity: utility concerns and regulations in a digital substation.

Supported by OMICRON

**DERMS – BALANCING BUSINESS AND RELIABILITY: BEST PRACTICES**

**Presidents:**
- Farid Katiarei, Quanta Technology
- Aleksy Paaso, ComEd
- Tamer Roussan, Ameren
- Famaz Farzan, Quanta Technology
- Douglas Proudfoot, Quanta Technology

Large scale deployment of Distributed Energy Resources (DER) fundamentally changes distribution system planning and operation, although at low levels of DER penetration, the impacts remain relatively benign, at higher levels, operation of the system changes markedly as the operator needs to handle different load-generation conditions, coordinate with other grid modernization efforts, anticipate and respond to different grid disturbances and reliability requirements.

Supported by Quanta Technology

**CONDUCTOR VIBRATION SENSORS AND FREQUENCY ANALYSIS: INCREASING THE CAPACITY OF CONSTRAINED TRANSMISSION LINES WITH DYNAMIC LINE RATING**

**Presenter:**
- Joey Alexander, Ampacimon

Overhead lines can be thermally constrained, especially in areas of transmission and sub-transmission that are affected by renewable or distributed power integration, and in areas where network extension or reinforcement is problematic. Line transit capacity (“ampacity”) is vastly affected by local weather conditions (wind, ambient temperature and solar radiation). Safety rules are imposed on line design (tower heights, clearances and tension) to take into account worst-case scenarios. Mature dynamic line rating (DLR) technologies identify significant available gains while maintaining, if not improving, safety of operation. They are cost-effective and can be deployed swiftly, without modifying the existing infrastructure. Sensors equipped with earthquake-grade accelerometers are capable of measuring the aeriel vibrations of conductors in very high resolution. Real-time frequency and waveform analysis reveal line characteristics such as line sag and perpendicular wind speed to produce a dynamic line rating.

Supported by Ampacimon
**SUPER SESSION**

**SS03 **
ELECTRIFYING THE ECONOMY: CHALLENGES AND OPPORTUNITIES
8:00am – 10:00am

**Moderator:**
Jim Mazurek, Managing Director, Accenture

**Panelists:**
Michelle Blaise, SVP of Engineering and Project Management, ComEd
Damir Novosel, President, Quanta Technology
Ramon Leon Candela, Head, New Energy Business Development, ISA, Colombia
Chris Root, COO, VELCO

Electrification is here, and it’s changing the way we frame transportation, urban planning and communities at large. Power industry leaders explore the impact of electrification on the economy, unpacking both the challenges and the opportunities that accompany this pioneering phenomenon.

**PANEL SESSIONS**

**PS9 **
STRATEGIC ASSET MANAGEMENT PLANNING
10:15am – 12:15pm

**Moderator:**
Robert Otal, METSCO

**Panelists:**
Andrew Barrett, CEATI
Albert Schwarz, Yukon Energy
Parupalli Suneetha, ComEd

Utilities across North America are facing ever increasing challenges to balance a number of often-competing objectives, including balancing capital and operational spending, making rates as digestible as possible for customers, keeping the lights on for customers and being able to prudently justify all investments with internal and external (e.g., state regulatory agencies) stakeholders. This panel session will provide insight into the different asset management (AM) policies, standards, strategies and risk-based methodologies that encompass the overall strategic AM frameworks that utilities have adopted in order to balance each of these competing objectives and ultimately ensure that they are making the right decisions to the right assets at the right time. Utility presenters will provide their own individual insights and experiences into strategic AM planning, including the introduction of AM policies, standards and strategies, decision-making tools and technologies, and the key applications they have been able to generate.

**PS18 **
LESSONS LEARNED FROM DEVELOPING REGIONAL ELECTRIC VEHICLE CHARGING INFRASTRUCTURE IN WESTERN UNITED STATES
10:15am – 12:15pm

**Moderator:**
Masood Parvania, University of Utah

**Panelists:**
James Campbell, PacifiCorp
Regan Zane, Utah State University
Linda Bluestein, U.S. Department of Energy

This panel session will bring together stakeholders from utilities, state and local government, university and national labs to discuss the lessons learned from developing a network of electric vehicle charging infrastructure in the western United States. The network includes residential, commercial and public chargers, as well as electric bus charging stations and charging stations along interstate 15 and 80.

**PS24 **
EVALUATION OF ADVANCED DISTRIBUTION MANAGEMENT SYSTEMS (ADMS) USE CASES USING NREL’S ADMS TESTBED
10:15am – 12:15pm

**Moderator:**
Murali Baggu, NREL

**Panelists:**
Kevin Fox, Duke Energy
Eric Gupta, Xcel Energy
Scott Koehler, Schneider Energy
Chris Bilby, Holy Cross Energy
Jose Castillo, Survant

This panel session will discuss the results and outcomes from evaluation of three different use cases including feeder voltage regulation with high-penetration PV using advanced inverters and an Advanced Distribution Management System (ADMS); distribution model quality and telemetry impacts for optimal ADMS performance; and peak load management supporting grid modernization through non-wires alternatives and ADMS deployments. The evaluation of use cases is performed using the ADMS Testbed in the Energy Systems Integration Facility (ESIF) at the National Renewable Energy Laboratory (NREL). The ADMS Testbed mimics realistic utility environments by including a combination of utility management systems and field equipment integrated with power system simulations using power/controller
hardware-in-the-loop techniques. The ADMS Testbed, funded by the Department of Energy Office of Electricity’s Advanced Grid Research Program, is a national, vendor-neutral evaluation platform with the purpose of accelerating industry development and adoption of ADMS capabilities for the next decade and beyond.

PS38 MODELING INVERTER-BASED RESOURCES: CHALLENGES, SUCCESSES AND DIRECTIONS 10:15am – 12:15pm

Moderators: Deepak Ramasubramanian, EPRI
Panelists: Ryan Quint, NERC
Brad Marszalkowski, ISO-NE
Nihal Mohan, MISO
Fred Huan, ERCOT
Evangelos Farantatos, EPRI

This panel session will explore industry efforts to ensure that the dynamic models used to represent inverter-based resource in bulk power system planning assessments reasonably capture the behavior of these resources and suitably capture the possible reliability issues that may arise. The panel will explore RMS positive sequence modeling practices and the existing challenges facing the industry today, as well as successes in improving the dynamic models based on NERC disturbance analyses detecting systemic modeling issues across North America. The panel will also explore the use of EMT models to capture more advanced grid reliability issues such as subsynchronous control interactions, controls instability, low short circuit strength system performance and other relevant issues.

PS45 QUANTUM COMPUTING 10:15am – 12:15pm

Moderator: Liuxi (Calvin) Zhang, ComEd
Panelists: Fred Chong, University of Chicago
Amin Khodaei, University of Denver
Ali Javadi, IBM

Quantum computing is the research area centered on creating computer technology that uses quantum theory concepts that explain the nature and conduct of energy and matter at the level of the quantum (atomic and subatomic). As it transforms how computing is done, it can enhance how the grid is planned, designed and operated. This panel session will explore the basic elements of quantum computing and the potential of quantum computing to improve analytical and computing capabilities in solving power system problems.

PS48 SUSTAINABLE AND HOLISTIC INTEGRATION OF ENERGY STORAGE AND SOLAR PV (SHINES) PROGRAM RESULTS AND IMPACTS 10:15pm – 12:15pm

Moderator: M. Kernal Celik, Department of Energy
Panelists: Liuxi (Calvin) Zhang, ComEd
Aminul Huq, Electric Power Research Institute
Panayiotis (Panos) Moutis, Carnegie Mellon University

Integrated grid automation can improve the speed, cost and accuracy of crucial distribution functions such as feeder switching, voltage and equipment health monitoring and outage, voltage and reactive power management. This panel session will provide a robust discussion on the reliability improvements and benefits to customers from the deployment of grid automation technologies and systems. The panel will help identify current trends and future challenges in key capabilities improved through grid automation including fault location, isolation and service restoration, distribution system resilience to extreme weather events, equipment monitoring and preventive maintenance, efficient use of repair crews and truck rolling and grid integration of distributed energy resources (DER).

PS54 ADVANCING GRID CONTROLS: CONTROLLING THE EDGE 10:15am – 12:15pm

Moderator: Paul Pabst, ComEd
Panelists: John Kelly, IPP Connect
Shashank Pande, Siemens
Ben Kregel, ComEd
Ivan Aguilar, APS

As the utility grid is continuing to advance into more automation, intelligence, predictive analysis, big data and other features, it is commanding a need for more robust control systems across its entire network. This panel session will investigate how utilities and manufacturers are keeping up with the demand for industry advancement and explore pilot projects, lessons learned and a vision for the future on grid edge device controls.

PS46 VALUING DER 1:00pm – 3:00pm

Moderator: Nina Selak, ComEd
Panelists: Liuxi (Calvin) Zhang, ComEd
Ralph Masoni, Quanta Technology
Amin Khodaei, University of Denver
Richard Tabors, Tabors Caramanis Rudkevic

As the importance of DER has become increasingly understood a wide range of stakeholders, including electric utilities, have been trying to understand how to recognize the value they provide to the grid. These values can be realized by different stakeholders or parties including the consumer, utilities, grid operators, markets and perhaps a whole. During this panel session, we will hear about the ways DER can provide value and how different states are beginning to develop and implement policies to recognize that value. Challenges associated with calculating the value and how this question is deeply associated with considering non-wire alternatives in planning will also be discussed.

PAPER FORUM SESSIONS

FORUM EMERGING TECHNOLOGIES, INTELLIGENT SYSTEMS AND SMART BUILDINGS 8:00am – 10:00am

Papers and Authors: 2020TD0193: A Novel Design of Concurrent Cyber Attacks in Cooperative DC Microgrids Jingaiu Zhang, National University of Singapore
Jimmy Chih-Wei Peng, National University of Singapore

These regulations have been proposed due to the warming potential of SF6 when it escapes to the atmosphere. This panel session will explore regulation impacts, strategies for regulation compliance, SF6 replacement technologies, and implications to alternative equipment deployment in a substation environment due to changing operational characteristics with alternate technologies. Panel commentary will be furnished by equipment manufacturer, utility representatives facing regulatory change and engineering professionals experienced in permitting and operational impacts.
Jun Yan Siu, National University of Singapore

2020TD0310: An Approach to Condition Assessment of High-Voltage Insulators by Ultrasound and an Ensemble of Fourier Neural Networks
Arthur Campos, University of São Paulo - USP
Gabriel Gomes, University of São Paulo - USP
Daniel Araujo, University of São Paulo - USP
Frederico Silva, University of São Paulo - USP
Rafael Fehlberg, University of São Paulo - USP
Bruno Sardinha, University of São Paulo - USP
Rodrigo Fauzino, University of São Paulo - USP

Zita Vale, Polytechnic of Porto
Fernando Lezama, Polytechnic of Porto
Ricardo Faia, Polytechnic of Porto

2020TD0222: Aggregation of Prosumers in the Context of Demand Response and Distributed Generation Remuneration and Scheduling
Catia Silva, Polytechnic of Porto
Pedro Faria, Polytechnic of Porto
Zita Vale, Polytechnic of Porto

2020TD0098: Challenges and Solutions for MV Neutral Treatment Earth Fault Detection and Localisation
Hugh Borland, ESB NETWORKS

2020TD0104: Improving Power Grid Transient Stability and Transfer Capability Using HVDC Emergency Power Controls
Lakshmi Sundaresh, University of Tennessee
Zhiyong Yuan, Oak Ridge National Laboratory
Kaiqi Sun, Electric Power Research Institute of China
Southern Power Grid
Jingping Pan, Shandong University
Yili Liu, University of Tennessee

FORUM 8
TRANSFORMERS, SWITCHGEARS AND SUBSTATIONS
10:15am – 12:15pm
Papers and Authors:
2020TD0103: Power Transformers: Mitigate Environmental Impact and Fire Risk Reduction and be Prepared for the Unexpected
Ewald Schweiger, Siemens AG
Eduardo Gomez Hennig, Siemens
David Calitz, Siemens Industry, Inc.
Scott Gray, Siemens Industry, Inc.

2020TD0124: Recovery Voltage at Transformer Limited Fault Interruption
Tomoki Saita, Tokyo Denki University
Yukihiko Himata, Tokyo Denki University
Tadashi Koshizuka, Tokyo Denki University
Kunihiro Hidaka, Tokyo Denki University
Eichi Hagiwara, The University of Tokyo, AIST
Takashi Shinkai, Tokyo University of Technology

2020TD0172: Prediction of Temperature Performance for SF6 Alternative Gas Mixtures
Ang Xiao, 3M Company
John Owens, 3M Company

2020TD0246: Modeling the Winding Hot-Spot Temperature and Aging of Enclosed Vault Transformers Using a Physics-Based Heat Transfer Model
Poorva Bedge, Colorado State University
Gerald Duggan, Colorado State University
Daniel Zimmerle, Colorado State University
James Spaulding, Fort Collins Utilities Light and Power

2020TD0248: Analytical Modeling of a Three-Phase Magnetic Amplifier-Based Continuously Variable Reactor
Subash Pokharel, University of Central Florida
Aleksandar Dimitrovski, University of Central Florida

2020TD0285: Staged Investment for Intelligent Automatic Transformers Winding Manufacturing Lines
Orlando Giraldo, Cargill, Inc.
Kevin Rapp, Cargill, Inc.

2020TD02010: Moving to Single-Phase Voltage Regulation Saves Utility Costs, Improves Power Quality for Industrials
Hossein Ghassempour Aghamolki, Eaton
Richard Kaluzny, Eaton
Jonathan Schaar, Eaton
Amar Thomas, Eaton

Christopher Morton, Powertech Labs, Inc.
Eric (Qian) Li, Powertech Labs, Inc.

2020TD0108: Improving Power Grid Transient Stability and Transfer Capability Using HVDC Emergency Power Controls
Lakshmi Sundaresh, University of Tennessee
Zhiyong Yuan, Oak Ridge National Laboratory
Kaiqi Sun, Electric Power Research Institute of China
Southern Power Grid
Jingping Pan, Shandong University
Yili Liu, University of Tennessee

2020TD0140: Improving Power Grid Transient Stability and Transfer Capability Using HVDC Emergency Power Controls
Lakshmi Sundaresh, University of Tennessee
Zhiyong Yuan, Oak Ridge National Laboratory
Kaiqi Sun, Electric Power Research Institute of China
Southern Power Grid
Jingping Pan, Shandong University
Yili Liu, University of Tennessee

2020TD0298: New Dual Nameplate kVA for Distribution Transformers
Kavin Rapp, Cargill, Inc.
Phil Hopkins, HVW
Dan Mulkey, Mulkey Engineering

2020TD0325: Staged Investment for Intelligent Automatic Transformers Winding Manufacturing Lines
Orlando Giraldo, The H-J Family of Companies
Gord Atamanchuk, MPM Canada

2020TD0052: Application of Site Controllers for Electrification of Commercial Fleet Vehicles
Rishabh Jain, National Renewable Energy Laboratory
Santosh Veda, National Renewable Energy Laboratory
William Becker, National Renewable Energy Laboratory

2020TD0261: Microgrid Seamless Transitions Between Grid-Tied and Islanded Operation: A Case Study
Michael Higginson, S&C Electric Company
Keith Moore, S&C Electric Company
Bob Harwig, S&C Electric Company
Peter Curtiss, S&C Electric Company
Himanshu Tiwari, S&C Electric Company

2020TD0009: Challenges and Solutions for MV Neutral Treatment Earth Fault Detection and Localisation
Hugh Borland, ESB NETWORKS

2020TD0261: Microgrid Seamless Transitions Between Grid-Tied and Islanded Operation: A Case Study
Michael Higginson, S&C Electric Company
Keith Moore, S&C Electric Company
Bob Harwig, S&C Electric Company
Peter Curtiss, S&C Electric Company
Himanshu Tiwari, S&C Electric Company

2020TD0261: Microgrid Seamless Transitions Between Grid-Tied and Islanded Operation: A Case Study
Michael Higginson, S&C Electric Company
Keith Moore, S&C Electric Company
Bob Harwig, S&C Electric Company
Peter Curtiss, S&C Electric Company
Himanshu Tiwari, S&C Electric Company

Christopher Morton, Powertech Labs, Inc.
Eric (Qian) Li, Powertech Labs, Inc.

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Orlando Giraldo, The H-J Family of Companies
Gord Atamanchuk, MPM Canada
INNOVATION STAGES

REAL TIME SIMULATION: THE DIFFERENCE FOR DE-RISKING GRID MODERNIZATION PROJECTS
10:15am – 11:15am

Presenters:
Kati Sidwall, RTDS Technologies
Paul Forsyth, RTDS Technologies

Real time simulators, consisting of specialized hardware and software, allow for modeling of the power system with a high level of detail and granularity (via electromagnetic transient simulation) in real time. Real time operation allows for the connection of external equipment to the simulated environment in a closed loop (“hardware-in-the-loop testing”). Closed-loop testing allows insight into not only the device’s response to a massive variety of network conditions, but the impact of the device’s operation on the surrounding power system. It is unique in that it allows for system-based testing, focusing on multiple device testing, multi-vendor interoperability and device interactions.

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CLOSING RECEPTION
3:00pm – 4:00pm

Don’t miss your chance to win one of many great prizes during the Closing Reception.
EXHIBITOR LIST

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