PRE-CONFERENCE TUTOTIAL #1 (Tuesday, April 30th)

08:30 – 10:00 Dr. Feng Yuan Zhang, UTK

"Green Hydrogen as a Path to Decarbonization and Net-Zero"

Moderator: Dr. Kevin Tomsovic

Abstract: The "US National Clean Hydrogen Strategy and Roadmap" has targeted for green hydrogen production and utilization to help achieve a national goal of a 100% carbon-free electrical grid by 2035 and net-zero emissions by 2050. With rapid growth in industrial and transportation sectors, global hydrogen demand is expected to reach 150 Million Metric Tons (MMT) annually by 2030 and 614 MMT annually by 2050. Currently, nearly 95% of hydrogen of about 90 MMT is produced using fossil fuels, which results in over 10 kg of CO_2 per kg of H_2. Green hydrogen, defined as produced with zero-carbon emissions, is emerging as an enabler of decarbonizing energy sectors. Proton exchange membrane electrolyzer cells (PEMECs) for green hydrogen production have received increasing attention due to high efficiency/energy density and rapid response even at low-temperature operations. In this talk, hydrogen production, application and their challenges will be introduced. An innovative electrode design strategy will be highlighted to build electron/proton transport nanohighways to ensure that the whole electrode meets the triple-phase boundary, therefore significantly enhancing oxygen evolution reactions (OERs) and hydrogen evolution reactions (HERs) in PEMECs. Engineered electrocatalysts with nanostructures, including nanowire and nonosheet, create abundant active edges and nanopores, and promote electron/proton transport nanohighways for scalable, low-cost, and robust water electrolysis

Biography: Dr. Feng-Yuan Zhang is a Professor and founding director of NanoHELP in the Department of Mechanical, Aerospace and Biomedical Engineering at University of Tennessee, Knoxville (UTK). Prior to that, he had experience at University of Delaware, Penn State University, the University of California, Los Angeles and Stanford University. He received his B. S. and M.S. from Nanjing University of Aeronautics and Astronautics and received his Ph. D. from Nagoya University. His research interests lie in energy, thermofluid, micro/nanotechnology, multifunctional materials, advanced manufacturing, propulsion, sensors, and state-of-the-art spectroscopies and diagnostics. He has been team leader or investigator for numerous projects on hydrogen production, water electrolyzers, fuel cells, pulse detonation engines, arcjet thrusters, electrochemical reduction of CO2/N2 to high-value products, and advanced instrumentation. His group develops thin and well-tunable liquid/gas diffusion layers (LGDLs) and catalyst-coated LGDLs (CCLGDL) with desired transport, catalytical, electrical and thermal properties, and investigates *in-situ* microscale ultrafast electrochemical reactions, interfacial effects and microfluidics in electrolyzer cells. Multiple conventional parts are integrated into one multifunctional plate with advance manufacturing to reduce the weight, volume and component quantity. More information can be found at http://fzhang.utsi.edu/default.htm or http://nanohelp.utk.edu/.

PRE-CONFERENCE TUTOTIAL #2 (Tuesday, April 30th)

10:30 – 12:00 Dr. Sandra Bogetic, UTK

"Small Modular Reactors to Contribute in the Future of Grid Decarbonization"

Moderator: Dr. Kevin Tomsovic

Abstract: Advanced Small Modular Reactors (SMRs) are a key part to develop safe, clean, and affordable nuclear power options. These advanced reactors, envisioned to vary in size from tens of megawatts up to hundreds of megawatts, and can be used for power generation, process heat, desalination, or other industrial uses. The goal of advanced SMRs offer many advantages, such as relatively small physical footprints, reduced capital investment, ability to be sited in locations not possible for larger nuclear plants, and provisions for incremental power additions. SMRs are considered as a readily power plant as slot into brownfield sites in place of decommissioned coal-fired plants, the units of which are seldom very large – more than 90% are under 500 MWe, and some are under 50 MWe. SMRs also offer distinct safeguards, security and nonproliferation advantages.

Small- sized modular reactors are an option to fulfil the need for flexible power generation for a wide range of applications. Among them, SMRs deployable either as a single or multi-module plant, offer the possibility to combine efficiently nuclear with alternative energy sources, including renewables. Reduced source term and relatively low thermal output of an individual SMR unit expand the options for siting, which enable closer positioning regarding power customers, or even co-location with heat processes and a reduction in the required water to support waste heat rejection. In addition to the more traditional electric power role of nuclear power plants, non-electrical product streams can be supported by SMRs (i.e., desalination, hydrogen production…). It might then be possible to transition SMR output among multiple hybrid energy product streams depending on the demand. This allows large electric power variations without affecting the SMR core thermal power that is kept constant during load following. Finally, advanced SMRs may include design specificities such as innovative fuel elements (accident tolerant fuels) or innovative reactivity power control that may reduce the core solicitations during load following and thus increase the achievable core power ramps.

Biography: Dr. Sandra Bogetic is an Assistant Professor at the University of Tennessee- Knoxville. Her research focus lay in a variety of fields from advanced simulation, developing and validating neutron and photon transport modeling capabilities, optimization software for designing more efficient advanced reactor with expanded range of applications. Her research includes novel concepts in the reactor design space for advancing reactor core design, as for developing new methods for safeguards and nonproliferation of Advanced Reactor (i.e., SMRs and Pebble Bed Reactors, etc.). One of her focus at UTK has been the development and validation of the flexible-subcritical- multiplying facility being built at UTK: the Flexible Neutron Source (FNS), the new one-of-a-kind facility that aims to support new reactors' deployment. Dr. Bogetic obtained her PhD in 2020 from the University of California, Berkeley. Before joining UTK, she worked at Livermore National Laboratory (LLNL) as a Graduate Scholar Fellow and NSSC affiliate student, and as a postdoctoral researcher.

KEYNOTE SPEAKER #1 (Tuesday, April 30th)

13:30 – 14:00 Darrel Moore, NERC

"Challenges in the Electric-Gas Energy System"

Moderator: Dr. Yilu Liu

Abstract: As the energy transition gains momentum, it presents unique hurdles for utility operators and managers, as well as power system service providers. These challenges encompass the integration of variable renewable energy sources, grid stability and reliability concerns, and the need to modernize infrastructure to accommodate the evolving energy landscape. In the coming decade, this means substantial investments in renewable resources can be expected, creating new opportunities and challenges for bulk power system reliability. Some of this new equipment will require modernized testing, standards, and training requirements. Testing technologies will need to evolve to support asset management programs and focus on services, measurement, and automation. And today, the role of artificial intelligence, the increased need for automation, and cyber secure designs are just some of the many additional factors to be considered in this evolution. The big question is, how can the industry step up its game to support higher levels of reliability and compliance as the electric sector transitions to the electrification of everything?

Biography: Darrell Moore joined NERC in September 2012 and has held several positions including, Senior Analyst, Manager of BPSA, Associate Director of BPSA and PCCM, and Director of BPSA and PCCM. He is currently serving as Director of NERC's Bulk Power System Awareness (BPSA) and Personnel Certifications and Credential Maintenance (PCCM). As the director, Mr. Moore is responsible for collecting and analyzing information on system disturbances and other incidents that could have an impact to the North American bulk power system (BPS). He also supports NERC's System Operator Certification Program, promoting the reliability of the North American BPS by ensuring that employers have a workforce of system operators that meet minimum qualifications. Mr. Moore has over 37 years of experience in the electrical utility industry in logistics, substation maintenance, scheduling, situation awareness, and system operations. Before joining NERC, Mr. Moore worked for Southern Company, and its subsidiaries, Gulf Power Company and Georgia Power Company, for 27 years, holding several positions in generation, logistics, transmission, and system operations. Mr. Moore started his career in 1985 in generation. In 1988, he transferred to a Transmission Maintenance organization, working in a substation department, and in 1999 transferred to System Operations where he held several positions of increasing responsibility until retiring in 2012. Mr. Moore earned his Bachelor of Science degree in Business Management and his Master's Business Degree (MBA) business management from Saint Leo University and holds a State of Georgia Unrestricted Electrical Contractors License. Darrell is a Senior Master Sergeant in the United States Air Force Reserves, retired 1998.

KEYNOTE SPEAKER #2 (Tuesday, April 30th)

14:00 – 14:30 Dr. Olga Spahn, ARPA-E

"Power Semiconductor Technologies for Improved Grid Control, Resilience, and Reliability"

Moderator: Dr. Fred Wang

Abstract: Technological advances in power electronics have enabled unprecedented growth of renewable energy sources in the electrical power grid. Moreover, decarbonization efforts rely on the electrification of everything from transportation to industrial processes, causing a dramatic increase in demand for electricity. Power electronics have the potential to minimize the increased demand, but new approaches are needed to improve the performance and actuation speeds. ARPA-E has an extensive power electronic portfolio with significant efforts in key technology enablers to improve grid control, resilience, and reliability. Its recent program - Unlocking Lasting Transformative Resiliency Advances by Faster Actuation of power Semiconductor Technologies (ULTRAFAST) seeks to advance the performance limits of silicon, wide bandgap, and ultrawide bandgap semiconductor devices and significantly improve their actuation methods to support a more capable, resilient, and reliable future grid.

This talk will focus on ARPA-E perspective on power electronics for the future grid and its resiliency and reliability, as well as other applications. Selected past and current power electronics programs at ARPA-E will be reviewed and some example activities will be discussed.

Biography: Dr. Olga Spahn currently serves as a Program Director at the Advanced Research Projects Agency-Energy (ARPA-E). Her focus at ARPA-E is on grid resiliency, power management and distribution, aviation and instrumentation for harsh environments leveraging optical and semiconductor device technologies.

Before joining ARPA-E, Dr. Spahn managed Advanced and Exploratory Systems at Sandia National Laboratories where she oversaw new system development and technology maturation activities for Nuclear Deterrence applications. Prior to that, she managed the Semiconductor Material and Device Sciences department where she focused on advancement of wide- and ultrawide- bandgap semiconductor devices and applications, which earned an R&D 100 Award. Her experience as a principal investigator spans technology development for nuclear non-proliferation, photonics and optoelectronics, optical MEMS, and laser material processing.

Dr. Spahn holds her B.S. in Electrical Engineering from University of Illinois Urbana-Champaign, M.S. and Ph.D. in Electrical Engineering from University of California, Berkeley. She has published more than 90 publications, holds 3 patents, and is a co-author of several book chapters.

KEYNOTE SPEAKER #3 (Tuesday, April 30th)

14:30 – 15:00 Fred Jones, Raytheon

"Cyber Safe Communities – A Conceptual Architecture for Securing Critical Infrastructure and Local Citizens"

Moderator: Dr. Frangxing "Fran" Li

Abstract: RTX has developed a novel framework to address the security of America's critical infrastructure and local communities. The goal of this framework is the deployment of cybersecurity best practices and technologies across the US at scale but with local governance and control. In this framework, the US is geographically subdivided into "Cyber Districts" which align with current municipal boundaries and roughly approximate the size of zip code regions. Within a Cyber District, residents are provided access to a community owned and operated secure local area network similar to a corporate LAN. The intent is to provide secure networking for high consequence, regulated transactions such as financial and medical records along with other critical infrastructure interactions. Cyber Districts enable pooled risk and community-level data ownership and control, and ultimately cyber-physical resiliency on a national scale. In this talk Fred will share this vision of Cyber Safe Communities, provide a quick history of the United States Postal Inspection Service, and solicit feedback on how to shape the concept moving forward.

Biography: Fred Jones is a Senior Technical Fellow with Raytheon Technologies Research Center. He has 24 years of experience in the Aerospace Defense Industry, with the past 10 years focused on leading Cyber Research & Development programs. He was the Cyber Technology Area Director for Raytheon and a subject matter expert for the Raytheon team supporting the DARPA Cyber Assured Systems Engineering (CASE) program. Fred also has subject matter expertise in hardware reverse engineering techniques, anti-tamper technologies, Cyber & Electro-Magnetic Activities (CEMA), firmware security, and the application of spintronics to security challenges. He is an accomplished embedded systems software engineer, winning multiple technical excellence awards during his decade with the AMRAAM missile product family. Fred is a guest lecturer at the University of Arizona, focusing on open-source intelligence and social engineering techniques. He holds patents and trade secrets in the areas of Anti-Fragile Software Systems with WebAssembly, Zero Trust Endpoint Network Security, Integrating FPGAs into Digital Twins, and Software Assurance with Digital Twins. Fred has a Bachelors in Physics and Masters in Teaching from the University of Virginia, and a Masters in Systems Engineering from Johns Hopkins University.

KEYNOTE SPEAKER #4 (Wednesday, May 1st)

08:30 – 9:00 Dr. Y.C. Zhang, Utilidata

"Redefining the Grid from the Edge via Distributed AI"

Moderator: Dr. Yilu Liu

Abstract: The emergence of distributed energy resources (DERs) and IoT devices at the grid's edge is transforming electricity generation, distribution, and consumption. In this evolving landscape, harnessing artificial intelligence (AI) is essential for optimizing grid operations, enhancing reliability, and facilitating informed decision-making. This keynote will explore the role of GPU modules in reshaping the grid from the edge, revolutionizing how we monitor, control, and optimize grid operations. It will discuss how distributed AI will play a pivotal role in improving grid efficiency, reliability, and resilience, while unlocking new opportunities for renewable integration, demand response, and energy management.

Biography: Dr. Yingchen (YC) Zhang is the Vice President of Product Solutions at Utilidata, a technology company that brings open-source distributed artificial intelligence (AI) to the edge of the electric grid, accelerating decarbonization and improving service delivery. In his role, YC leads the development and growth of the company's product offerings. With over 15 years of experience in power systems operation, planning, markets, and technology development, YC brings a wealth of expertise to his position. He was most recently at the National Renewable Energy Laboratory, where he managed a research group focused on pioneering the application of artificial intelligence in renewable integration. YC is a graduate of Tianjin University in Tianjin, China, and earned his Ph.D. from Virginia Tech. YC currently serves as the Chair of the Renewable System Integration Coordination Committee of the IEEE Power and Energy Society.

KEYNOTE SPEAKER #5 (Wednesday, May 1st)

09:30 – 10:00 Dr. Peter Barbosa, Delta Electronics

"Components, Systems, and Grid Interface Challenges Related to Solid-State Transformers in Emerging Applications"

Moderator: Dr. Fred Wang

Abstract: Due to the growing levels of power needs in data centers, fast EV charging, renewable energy, and other emerging applications, the demand for advanced medium voltage distribution systems is on the rise. These emerging high-power applications benefit from medium voltage distribution's lower conduction losses. Traditionally, bulky line frequency transformers are used to convert medium voltage AC to a more usable lower voltage AC or DC. Solid-State Transformer (SST) technology is emerging as a new technology, utilizing high-frequency semiconductor operation to decrease the size of transformers significantly. This keynote will address the implementation of solid-state-transformers and challenges related to topology, components, system scalability, modularity, and interface issues with grid.

Biography: Dr. Peter Barbosa serves as the Senior R&D Director at the Milan Jovanovic Power Electronics Laboratory, Delta Electronics, Raleigh. In this role, he dedicates to advancing technology for next-generation power conversion. His expertise encompasses a broad spectrum of power electronics systems, ranging from low- to high-voltage applications. Dr. Barbosa's work primarily focuses on the development of cutting-edge multilevel power converters, medium-voltage drives, high-efficiency & high-density power conversion technologies for EV charging and server power. He earned his Ph.D. in Electrical Engineering from Virginia Tech in 2002. After graduation, Dr. Barbosa developed his career in Europe, Asia, and the United States, respectively.

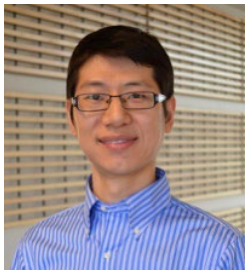
INDUSTRY/ALUMNI SESSION (Tuesday, April 30th)

15:30 – 16:30

Moderator: Sebastian Martinez Lizana

Micah Till, Dominion Energy

Liyan Zhu, Virginia Tech



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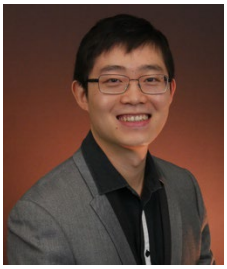

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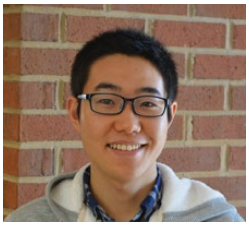

Yang Liu, Quanta Tech.

Derek Kou, EDP

Andrew Foote, Volkswagen

Ming Li, Space X

Mariana Kamel, EnerNex

Y.C. Zhang, Utilidata