IEEE ENERGY CONVERSION CONGRESS & EXPO Detroit, Michigan, USA Oct. 9-13

Special Session Proposal Form

Format: Maximum 5 pages. All pages are formatted to 8.5x11" or A4 paper with margins of one inch on every side. All texts use single space, Times New Roman, and a font size of 11 or 12.

Recommended Sections:

1. Special Session Title New developments in Wide-Bandgap Bidirectional Switches and Applications

2. Proposed Session Format Informal Talks: Panel Format with Q&A

3. Proposed Timing 100 minutes

4. Session Organizers Victor Veliadis PowerAmerica/NCSU, and Thomas M. Jahns University of Wisconsin – Madison

5. Session Speakers/Panelists (List names, titles, and affiliations. Clearly note each speaker's availability: choose "confirmed" or "tentative"; failure to do so will be treated as all tentative.)

1. **Dr. Victor Veliadis** — Chief Executive & CTO, PowerAmerica, and Professor, NCSU
   10min
2. **Dr. Subhashish Bhattacharya** — Professor, North Carolina State University (NCSU)
   10min
3. **Dr. Johann Kolar** — Professor, ETH Zurich, Power Electronics System Laboratory
   10min
4. **Dr. Thomas Jahns** — Professor, Univ. of Wisconsin – Madison, WEMPEC
   10min
5. **Dr. Bulent Sarlioglu** — Assoc. Professor, Univ. of Wisconsin – Madison, WEMPEC
   10min
6. **Michael Harris** — CEO, Atom Power, Charlotte, NC
   20min
7. **Dr. Xiaoqing Song** — Sr. Research Scientist, ABB US Corporate Research Center
   20min
8. **Final Q&A and closing**
   10min

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6. Abstract (No more than 500 words. Accepted abstract will be published through the conference website and program book.)

Monolithic bidirectional switches hold the potential to trigger a revolution in the future of power electronics technology. Unfortunately, an impressive catalog of high-performance power converter topologies designed to use bidirectional switches have never achieved marketplace success for lack of commercially- available monolithic BD (M-BD) switch devices. No silicon-based M-BD switch technology has emerged that has successfully crossed the threshold into large-scale production. New wide-bandgap power device technology using GaN and SiC has opened intriguing avenues to WBG-based M-BD switches that hold much higher promise for overcoming the barriers to commercialization. Both lateral and vertical M-BD device topologies have been proposed using GaN and SiC that have resulted in prototype devices with ratings as high as 1400V and 100A. The purpose of this special session is to **discuss new developments** in promising state-of- the-art WBG-based M-BD switch technology in a manner that objectively evaluates both their strengths and technical challenges. This session also highlights some of the most promising applications for this prospective new generation of M-BD switches as well as the most likely power converter topologies that will take fullest advantage of their availability. These application areas cover a wide spectrum extending from ac solid-state circuit breakers to static power converters to motor drives.

7. Session Outline (Only list the proposed topics/titles/activities. No detailed descriptions necessary. Indicate time allocation and speaker breakdown, if possible.)

1. ***Title:*** **WBG-based Solid-State-Bidirectional-Circuit-Breakers: Device Technology, andOpportunities and Barriers to Mass Market Adoption,** 10 min

   Presenter: **Dr. Victor Veliadis**, Chief Executive & CTO, PowerAmerica,

2. ***Title:*** **Monolithic SiC-based Bidirectional FET (BiDFET): Exploring Opportunities & Challenges,** 10 min

   Presenter: **Dr. Subhashish Battacharya**, Professor, North Carolina State University

3. ***Title:*** **Monolithic Bidirectional Switches – X-Technology of 3-Phase AC/DC Mains Interfaces,** 10 min

   Presenter: **Dr. Johann Kolar**, Professor, ETH Zurich

4. ***Title:*** **The Re-Emergence of Current-Source Inverters in Future Machine Drives Enabled by WBG-Based Bidirectional Switches,** 10 min

   Presenter: **Dr. Thomas M. Jahns**, Professor, University of Wisconsin - Madison

5. ***Title:*** **Power Scaling of Current-Source Inverter Technology with WBG-Based Bidirectional Switches to 100 kW for Electric Vehicle Applications,** 10 min

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Presenter: **Dr. Bulent Sarlioglu**, Assoc. Professor, University of Wisconsin – Madison, WEMPEC

6. ***Title:*** **How Solid-State Circuit Breakers Enable the Energy Transition and How WBG Semiconductors Play a Critical Role,** 20 min

   Presenter: **Michale Harris**, CTO, Atom Power

7. ***Title:*** **Solid-State Circuit Breaker: Opportunities and Challenges,** 20 min

   Presenter: **Dr. Xiaoqing Song**, Sr. Research Scientist, ABB US Corporate Research Center

8. Organizer Biography (No more than 200 words for each person. External website link can be included but may not be reviewed.)

Victor Veliadis is Executive Director and CTO of PowerAmerica, a member driven wide-bandgap (WBG) semiconductor power electronics consortium. At PowerAmerica, he has managed a budget of $150 million that he strategically allocated to over 200 industrial and University projects to accelerate WBG semiconductor clean energy manufacturing, workforce development, and job creation. His PowerAmerica educational activities have trained 420 University full-time students in applied WBG projects, and engaged over 4300 attendees in tutorials, short courses, and webinars.
Dr. Veliadis is an ECE Professor at NCSU and an IEEE Fellow and EDS Distinguished Lecturer. He has 27 issued U.S. patents, 6 book chapters, and over 140 peer-reviewed publications. Prior to entering academia and taking an executive position at Power America in 2016, Dr. Veliadis spent 21 years in the semiconductor industry where his work included design, fabrication, and testing of SiC devices, GaN devices for military radar amplifiers, and financial and operations management of a commercial semiconductor fab. He has a Ph.D. degree in Electrical Engineering from John Hopkins University (1995).

Thomas M. Jahns (M'79–F'93–LF'19) received the S.B., S.M. (1974), and Ph.D. (1978) degrees in electrical engineering from MIT, Cambridge, MA, USA. In 1998, he joined the Department of Electricaland Computer Engineering, University of Wisconsin-Madison, as a Grainger Professor of PowerElectronics and Electric Machines, where he is currently the Director of the Wisconsin Electric Machines and Power Electronics Consortium (WEMPEC). Prior to joining UW-Madison, he worked at GE Corporate Research and Development (now GE Global Research Center), Niskayuna, NY, for 15 years.His current research interests include high-performance permanent-magnet synchronous machines, electric propulsion drives, and integrated motor drives. Dr. Jahns received the 2005 IEEE Nikola Tesla Technical Field Award and the IAS Outstanding Achievement Award in 2011. He is a Past President ofPELS and served two years as Division II Director on the IEEE Board of Directors (2001-2002). He waselected as a member of the U.S. National Academy of Engineering in 2015.

9. Speaker/Panelist Biography (Confirmed speakers/panelists from #5 above must provide their tailored bios for the proposed session. No more than 200 words for each person. External website link can be included but may not be reviewed.)

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Subhashish Bhattacharya received his B.E. from IIT Roorkee, India, M.E. from IISc, India, and Ph.D. from the University of Wisconsin-Madison, all in electrical engineering. He worked in the FACTS and Power Quality group at Westinghouse, which later became part of Siemens Power, from 1998 to 2005. He joined the Department of ECE at NCSU in August 2005, where he is Duke Energy Distinguished Professor and a founding faculty member of NSF ERC FREEDM Systems Center, Advanced Transportation Energy Center [ATEC] and the US DOE initiative on WBG based Manufacturing Innovation Institute – PowerAmerica - at NCSU. His research interests are Solid-State Transformers, Integration of renewable energy resources, MV power converters enabled by HV SiC devices, FACTS, Utility applications of power electronics and power quality issues; DC Microgrids, high-frequency magnetics, active filters, and application of new power semiconductor devices such as SiC and GaN for converter topologies. His research is funded by several industries, NSF, DoE, ARPA-E, US Navy, ONR, NASA. He has over 500 publications and 10 patents with several pending patent applications.

Johann W. Kolar (M´89–F´10) received his M.Sc. and Ph.D. degree (summa cum laude) from the University of Technology Vienna, Austria, in 1997 and 1999, respectively. Since 1984, he has been working as an independent researcher and international consultant in close collaboration with the University of Technology Vienna. He has proposed numerous novel PWM converter topologies, modulation and control concepts and has supervised 75+ Ph.D. students. He has published 900+ journal and conference papers, and has filed 200+ patents. Dr. Kolar has received 35+ IEEE Transactions and Conference Prize Paper Awards, the 2014 IEEE R. David Middlebrook Achievement Award, and the 2016 IEEE William E. Newell Power Electronics Award. He served from 2001 through 2013 as an associate editor of the IEEE Transactions on Power Electronics. The focus of his current research includes ultra-compact and ultra-efficient SiC and GaN converter systems, advanced variable speed three-phase motor drives, integrated modular motor drives, ultra-high speed motors, and bearingless motors/ actuators. He was elected to the U.S. National Academy of Engineering as an international member in 2021.

Bulent Sarlioglu (M'94–SM'13) received the B.S. degree from Istanbul Technical University, the M.S. degree from the University of Missouri - Columbia, and the Ph.D. from the University of Wisconsin–Madison, all in electrical engineering. **Dr. Sarlioglu** is a Jean van Bladel Associate Professor at the University of Wisconsin-Madison and an Associate Director of the Wisconsin Electric Machines and Power Electronics Consortium. From 2000 to 2011, he was with Honeywell International Inc., Aerospace Division, most recently as a Staff Systems Engineer. His expertise includes electrical machines, drives, and power electronics, and he is the inventor or co-inventor of 20 U.S. and international patents. He has more than 250 technical papers that are published in conference proceedings and journals. Dr. Sarlioglu was the recipient of the Honeywell's Outstanding Engineer Award in 2011, the NSF CAREER Award in 2016, and the 4th Grand Nagamori Award from Nagamori Foundation, Japan, in 2018. Dr. Sarlioglu is currently one of the IEEE IAS distinguished lecturers. He serves as the Chair of the IAS Transportation Committee, Chair of PES Motor Subcommittee, one of the co-editors of the IEEE Electrification Magazine. Dr. Sarlioglu was the general Chair of ITEC 2018 and Technical Program Co-Chair for ECCE 2019 and special session chair in ECCE 2020.

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Mike Harris is CTO of Atom Power and a technology leader who has spent the past three decades transforming markets by delivering innovative products focused on unsolved customer needs. In diverse industries such as telecommunications, industrial systems and lighting with companies like Lockheed Martin, Cisco and Cree, Mike has sharpened his ability to connect technology to market impact. Mike joined Atom Power in 2019 with a goal of implementing a strategy that would position power distribution for the future. Mike holds 22 patents in the area of lighting, controls and power systems. He earned a Bachelor of Science degree in Electrical and Computer Engineering from Clarkson University.

Xiaoqing Song received the B.S. and M.S degrees with Beijing Institute of Technology, China, in 2009 and 2012, respectively, and received the Ph.D. degree with North Carolina State University, USA in 2017, all in electrical engineering. He joined ABB US research center since 2017, now is a senior research scientist and IEEE senior member. Dr. Song has published more than 35 journal and conference papers and hold more than 10 world and US patents applications and grants. He is the recipient of 2016 Outstanding Young EPE Member Award and 2020 ABB Inventor of the Year Award. Dr. Song has more than 5 years of experience in leading multi-discipline research and R&D projects in the field of solid state and hybrid circuit breakers and switches, protection coordination in LV and MV DC distribution systems. Dr. Song is also an expert in MV SiC power device design and applications.