

Special Session 19

Advanced Power Electronics Technologies in High-Penetration Renewable
Energy Grids

Introduction and Topics

With the large-scale integration of high-penetration renewable energy, advanced power electronics technologies, such as grid-forming converters, solid-state transformers, and modular multilevel converters, are crucial for enhancing system flexibility, dynamic stability, efficiency, and power quality. However, high-penetration grids exhibit characteristics such as low inertia, weak grid strength, and multi-timescale dynamics, against which traditional control methods face deficiencies in adaptability, coordination, and disturbance resistance.

Therefore, there is an urgent need to develop next-generation power electronics technologies with grid-support, black-start, and multi-device coordination capabilities. Through real-time sensing and adaptive control, these technologies can provide synthetic inertia and primary frequency response for frequency regulation, achieve dynamic reactive power compensation and impedance reshaping for voltage regulation, implement active filtering and impedance enhancement for oscillation suppression, and improve voltage levels and power density through modular series-parallel connections in high-voltage and high-power scenarios. Meanwhile, under conditions of low inertia, time-varying grid impedance, and communication delays, key challenges remain in ensuring the system stability, fault tolerance, and system-level interoperability of advanced power electronics solutions, warranting systematic research and demonstrations.

Topics including but not limited to:

1. Grid-Forming and Grid-Following Control for System Stability
2. Model and Control of DC-DC Converters
3. Novel Topologies and Control Methods for Advanced Power Electronic Systems
4. Fundamental and Practical Advancements of Power Electronics Semiconductor Devices
5. Wide-Band Oscillation Suppression via Active Filtering and Impedance Shaping
6. Fault-Tolerant Control and System-Level Reliability
7. Dynamic Voltage and Reactive Power Support in Weak Grids
8. Multi-Device Coordination and Scalability in Complex Grids
9. Hardware Design and Integration of Renewable Energy Systems
10. High-Voltage and High-Power Conversion and Application

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// Paper Submission //

Submission Method



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Important Dates

Submission Deadline	April 30, 2026
Notification Deadline	May 31, 2026
Early-bird Registration Deadline	June 15, 2026
Author Registration Due	June 15, 2026

Publication

Submissions to IEEE I&CPS 2026 will be peer reviewed on the basis of technical quality, relevance to conference topics, originality, significance, clarity, etc. Accepted papers will be submitted for inclusion into IEEE Xplore subject to meeting IEEE Xplore's scope and quality requirements.

Excellent papers will be recommended for review by IEEE Trans on Industry Applications (proportion can reach up to 50%), Global Energy Interconnection and DeCarbon.