

SEMINAR ANNOUNCEMENT

DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COLLEGE OF DESIGN AND ENGINEERING

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Area: Power and Energy Systems (PES)

Host: Prof Dipti Srinivasan

Organized by Green Energy Management and Smart Grid Research Center (GEMS), ECE NUS

TOPIC	:	Towards the Autonomous Power Grid
SPEAKER	:	A/Prof Nesimi Ertugrul The School of Electrical and Mechanical Engineering, Adelaide University, Australia
DATE	:	Wednesday, 7 October 2026
TIME	:	11:00AM to 12:00PM
VENUE	:	E3-06-01

ABSTRACT

The global push toward rapid electrification, driven by electric vehicles, smart infrastructure and high-density computing, is exposing the critical vulnerabilities of legacy AC power systems. Modern power grids are facing significant issues/problems, including reduced system inertia, high rate of change of frequency, severe voltage fluctuations, reverse power flow and rising operational costs. Conventional "band-aid" fixes applied to centralized AC architectures are no longer sufficient to maintain power quality, stability and security.

This presentation explores the key technical and architectural paradigms required to transition from legacy, centralized grids to next-generation autonomous microgrids and a decentralized "Internet of Energy". Emerging Wide Bandgap power electronics, enable high-frequency, bidirectional, and highly efficient four-quadrant power control, serving as the fundamental hardware enabler for a DC-centric grid. Furthermore, innovative strategies in AI and data centre load management can utilize heavy compute loads, such as non-time-critical AI model training, as "stored computation" to absorb excess renewable generation while minimizing battery storage reliance and curtailment.

The discussion also highlights practical insights and case study results on autonomous microgrids and grid resilience, demonstrating seamless grid segregation (islanding), rapid reintegration, high-speed harmonic management, and resilient fault responses without relying on legacy fault currents. In addition, it addresses the strategic alignment of energy storage systems, ranging from supercapacitors and flywheels to lithium-ion and flow batteries, across short-term regulation and long-term energy balancing timescales to ensure a resilient, efficient and secure energy future.

BIOGRAPHY

Nesimi Ertugrul holds a BSc and MSc both in Electrical and Electronics Engineering from Istanbul Technical University, and a PhD from the University of Newcastle upon Tyne, UK. Since 1994, he has been with the University of Adelaide, Australia, where he is an A/Prof. specializing in power electronics applications, particularly in renewable energy, grid scale battery storage systems and electric vehicles. His research interests also cover emerging magnetic materials for high efficiency electrical machines, DC microgrids, mining electrifications and wide bandgap power electronics.

He has supervised over 30 PhD and Master's students and led numerous research grants, funding initiatives, and consultancy projects. In addition, he has served as a guest editor for three scientific journals. His publication record includes four solo-authored books, four book chapters, more than 190 journal and conference papers and five patents. Two of his books, Reinventing the Power Grid: Renewable Energy, Storage, and Grid Modernization (CRC Press, 2025) and Techno-Economics of Offshore Renewable Energy: Wind, Wave, Energy Storage and Systems Integration (CRC Press, in Print), summarize and discuss the components of entire power grids, grid integration/transformation and economic aspects.

He has chaired international conferences, delivered keynote speeches, and served on technical committees. As a Senior Member of the IEEE, he has also been an Associate Editor for the IEEE Systems Journal.

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