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COMPUTATIONAL METHODS FOR RELIABLE AND AFFORDABLE POWER SYSTEMS PLANNING

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ABSTRACT

The rapid transformation of electric power systems is creating urgent needs for advanced computational methods that can support reliable and affordable energy infrastructure. Increasing proportion of distributed energy resources, electrification of end uses, extreme weather events, and evolving market and regulatory structures are placing new demands on planning and operational decision-making. These challenges require mathematical and computational approaches that can integrate large-scale optimization, uncertainty quantification, data-driven modelling, and high-performance computing into decision-support tools for real-world energy systems.

This Invited Session will highlight emerging research at the interface of applied mathematics, computational science, and power systems engineering applications. Topics may include generation and transmission expansion planning, integrated resource planning, grid reliability assessment, stochastic and robust optimization, decomposition and alternate acceleration methods, and evaluation methods for infrastructure investment strategies. Emphasis will be placed on methods that bridge mathematical innovation and practical deployment including approaches that support representation of extreme events; integration of distributed generation and storage resources; coordination across transmission, distribution, and end-use sectors; and decision-making under deep uncertainty.