Microgrids for Promoting Higher Resilience, Security, Reliability and Economics in Smart Cities

Mohammad Shahidehpour, IEEE Fellow
Robert W. Galvin Center for Electricity Innovation
Illinois Institute of Technology
Chicago, Illinois 60616, USA

Abstract - Microgrids represent a small-scale version of centralized electric power systems which are established by local communities in smart cities. Microgrids provide a more robust control of integrated renewable resources and battery storage at local communities and allow customer participation in the operation of critical electricity infrastructures. Microgrids promote the use of real-time pricing of electricity and demand response for optimizing the distributed control of electric power systems. In practice, microgrids are utilized to achieve specific goals pertaining to the distributed control of power systems which include higher reliability and fewer outages, higher resilience with self-healing capabilities, higher sustainability with more diversification of energy resources, more comprehensive control of wireless devices for managing cyber security, higher energy efficiency and lower operating costs. This presentation will review the significance of smart grid applications to power system operations and control, highlight some of the key issues in the design and the operation of renewable-based microgrids, and discuss the role of recent innovations in managing the resilience of critical infrastructures in smart cities. The presentation will also discuss the design and the operation of a campus microgrid, a hybrid AC/DC nanogrid, and a green data center, which are sponsored by the U.S. funding agencies and implemented at Illinois Institute of Technology.

Biography - Dr. Mohammad Shahidehpour is a University Distinguished Professor, Bodine Chair Professor of Electrical and Computer Engineering, and Director of the Robert W. Galvin Center for Electricity Innovation at Illinois Institute of Technology (IIT). He has also been the Principal Investigator of several research grants on power system operation and control. His project on Perfect Power Systems has converted the entire IIT Campus to an islandable microgrid. His CSMART (Center for Smart Grid Applications, Research, and Technology) at IIT has promoted the smart grid cybersecurity research for managing the resilience of wireless networked communication and control systems in smart cities. His SPIKE initiative facilitated the design and the implementation of affordable microgrids in impoverished nations. He is the recipient of the 2009 honorary doctorate from the Polytechnic University of Bucharest. Dr. Shahidehpour was the recipient of the IEEE Burke Hayes Award for his research on hydrokinetics, IEEE/PES Outstanding Power Engineering Educator Award, IEEE/PES Douglas M. Staszesky Distribution Automation Award, and the Edison Electric Institute's Power Engineering Educator Award. He has co-authored 6 books and 500 technical papers on electric power system operation and planning, and served as the founding Editor-in-Chief of the IEEE Transactions on Smart Grid.

Dr. Shahidehpour is a Fellow of IEEE, Fellow of the American Association for the Advancement of Science (AAAS), and a member of the US National Academy of Engineering.