Transactive Energy in Networked Microgrids for Enhancing the Resilience, Reliability, Security, and Economics of Distributed Electric Power Systems

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Abstract: Microgrids represent a small-scale version of centralized electric power systems, which are established in load centers like universities, hospitals, airports, military bases, and residential areas for enhancing the resilience, reliability, security, and economics of distributed power systems. Networked microgrids provide a robust control of integrated renewable resources and battery storage in energy-constrained communities and allow customer participations in the operation of critical infrastructures. With the increasing penetration of distributed energy resources and the proliferation of microgrids, transactive energy is considered as an enabler of end-to-end energy trading and coordinated operations among microgrids for lowering the energy costs in power distribution systems. However, transactive energy trading poses new operation challenges, which are managed by distribution system operators (DSOs) as networked microgrids interact with power distribution systems. The role of networked microgrid in distribution system operation is discussed in this presentation. The presentation discusses a bi-level framework to conceive an optimal trading strategy in the hierarchical operation of DSOs. The upper level operation considers a transactive energy market where networked microgrids participate to trade energy locally. The trading results are submitted to the lower level in which the DSO optimizes the distribution power flow and the distribution network reconfiguration. The proposed solution enables transactive energy trading decisions by networked microgrids and effective distributed energy market clearing by DSO. Case studies show the applications of the proposed framework and algorithm in the power distribution system operation.

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 550 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), Fellow of the National Academy of Inventors (NAI) and a member of the US National Academy of Engineering (NAE).