Abstract

Economics and environmental incentives, as well as advances in technology, are reshaping the traditional view of power systems. The majority of the current U.S. power grid infrastructure was built in the 1930s and has experienced five massive blackouts in the past 40 years, three of which have occurred within the past decade. The existing U.S. power grid infrastructure does not meet the growing electricity demand of the 21st century. U.S. government has spurred efforts to accelerate the upgrade of the aging U.S. electric grid, which is one of the largest engineered systems ever constructed. To address these challenges, Smart Grid has emerged as a new concept and a promising solution to restructure the current energy infrastructure and ensure the reliability of energy supply.

In this talk, we will first present an overview of Smart Grid operations. We will then focus on two smart grid operation topics: (1) Plug-in Electric Vehicle (PEV) Charging in Smart Grid; and (2) Smart Grid Energy/Power Management. In the first topic, we will discuss the impact of grid integration of PEV charging on electric power transmission and distribution systems. We will then discuss the proposed smart PEV charging schemes at public charging facilities (e.g., municipal parking deck) to maximize the customer preference and the utilization of existing power grid infrastructure. In the second topic, we will discuss the design and development of Smart Grid energy/power management systems for a future residential distribution system (“Energy Internet”). The proposed energy/power management systems consider the inherent intermittency and variability of renewable energy resources and the spatial and temporal uncertainty of controllable loads. We will also present an innovational electricity market framework that can facilitate the real-world deployment of the “Energy Internet”. Finally, we will conclude this talk with a discussion on future research trend in Smart Grid operations.

Biographical Information

Wencong Su received his B.S. with distinction in Electrical Engineering from Clarkson University in May 2008 followed by an M.S. in Electrical Engineering from Virginia Tech in December 2009. He is a Ph.D. candidate in the Department of Electrical and Computer Engineering at North Carolina State University. He is currently a graduate research assistant at NSF ERC - the Future Renewable Eclectic Energy Delivery and Management (FREEDM) Systems Center and Advanced Transportation Energy Center (ATEC). He worked as a Research Aide at Argonne National Laboratory in IL, from January to August 2012. He also worked as a R&D engineer intern at ABB U.S. Corporate Research Center in Raleigh, NC, from May to August 2009. He received 2011 Chinese Government Award for Outstanding Students Abroad. He is a full member of Sigma Xi society. His research interests include Smart Grid, Microgrid, Grid Integration of Plug-in Electric Vehicles and Renewable Energy, Computational Intelligence, Power System Modeling and Simulation. He has accumulated a long list of peer-reviewed journal and conference publications in Smart Grid area.