Advanced electricity power grid essay sample

The electric power transmission grid is one of the largest and the most complex networks built by the human being. The rapid growth of distributed energy resource(DER) technologies adds more stress for controlling the stability of the electric grid. New forms of electricity, like wind power and solar power, produce a large amount of the energy which need more requirements for energy storage. Coordination and scientific interaction of these resources remains an open research challenge [1].

Firstly, the development of accurate and usable formal models of the physical power-grid and its supporting cyber-infrastructure, together with integration of hardware/software semantics (e. g., through co-design) are important research challenges to ensure compliance with system constraints, allow optimization, and manage the complexity of the system.

In order to obtain models the design, verification, and validation of the actual system, techniques and educational processes are required that (1) uncover the semantic mismatches that exist between application requirements, system software behavior, economics, ethics, resource management precision, and behavioral information collected about the system, (2) uncover the semantic inconsistencies that exist between requirements, design specification, hardware/software/physical implementation, and other system artifacts, and (3) thus, make modeling, co-analysis, and co-design possible.

Secondly, to coordination of the grid in real time is crucial: for example, two FACTS (flexible AC transmission systems) devices can compete, in effect causing the controlled system to “ ring” (cause a deadlock). As a result, the efficiency of coordination for both long term and dynamic control across multiple distributed networked FACTS devices is so important. Important open research problems in the area of real-time control for the Advanced Power Grid include, (1) effects of different communication and computation delays on both long-term and dynamic control properties (both physical and cyber), (2) co-design of control and monitoring feedback loops, and (3) formal models of the timing behavior of power grid control, monitoring, and actuation elements in conjunction with the timing behavior of system software elements.

Last but not least, the system's safety, liveness, fault tolerance, information security, and robustness, are critical to power grid control. In addition to the assurances of timing and information flow, robust power grid management approaches therefore must also provide security from interference with crucial system computation and communication activities by faults or adversarial actions, both in the cyber domain consisting of the embedded computers and communication networks, and in the physical domain consisting of the power system itself.