Coupled Cascading Failure in Energy CPS: Modeling, Prevention, and Restoration

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Motivation
- Cascading failures in the electrical energy cyber-physical system (CPS)sub-categorize a significant amount of customer-hours of lost electricity service that is comparable to major natural disasters. Modeling, prevention, and recovery is the focus.

Objectives
- The goal is modeling, prevention, and restoration of coupled cascading failures in power and communication systems.

Key challenges
- Mitigating cascade by generation rescheduling considering stability limits and uncertainty in controllability and observability
- Integrating the proposed preventive controls with CPS model

Restoration following cascading failure/natural disaster
- Lack of information from sensors
- Uncertainty about failure location

Scientific and broader impacts
- Theories developed for fundamental understanding of cascading failures in energy CPS can be applied to other CPSs, which are coupled cyber-physical systems having a dynamic physical system.
- Proposed preventive control strategy can protect critical infrastructures from large-scale outages.
- Proposed recovery strategy is applicable in the aftermath of a blackout caused by a natural disaster, or other event, which will reduce downtimes of the critical infrastructure.
- Proposed research will be integrated into the one-week summer camps offered by the School of ECE at Penn State. Presentations about this research will be given to high school students over the course of the week on this topic in the 2019 camps, and then a camp focused on curriculum on the topics of this research will be offered in 2020.

Prevention of cascading failure

Papers in the proceeding: [https://www.nsf.gov/awardsearch/showAward?AWD_ID=1836827]