SECURE AND RESILIENT WIRELESS COMMUNICATIONS FOR DISTRIBUTED ELECTRIC GRID OPERATIONS, 5G CAPABILITIES

WEDNESDAY: SESSION 4, TRACK 2

SESSION CHAIR

Brad Nelson, Idaho National Laboratory

PRESENTERS

- Daniel Bennett, National Renewable Energy Laboratory
- MD Touhiduzzaman, National Renewable Energy Laboratory
- James Ogle, Pacific Northwest National Laboratory
- Brad Nelson, Idaho National Laboratory

SESSION ABSTRACT

United States electric grid owners and operators are rapidly transitioning to new grid technologies, grid architectures, business models, integration of distributed energy resources (DER) with non-utility participants. In parallel, the use of wireless communications for electric grid operations is increasing dramatically as technologies and capabilities available to electric grid owners and operators are advancing at historic rates. These emerging trends are resulting in fundamental challenges to the secure and resilient operations of the electric grid including situational awareness, coordination, control, and new interactions with non-utility participants.

This session will include two presentations.

The first presentation Idaho National Laboratory and Pacific Northwest National Laboratory will explore these emerging trends and describe several DOE initiatives that are focused on developing new frameworks and methodologies for analyzing various options to address the challenges associated with these trends. These include new grid architectures, grid control approaches, and integrated grid and communications planning.

The second presentation will describe work underway at the National Renewable Energy Laboratory addressing a key challenge of integrating secure and resilient DER assets utilizing several emerging 5G capabilities.

Grid integration of variable, inverter-based, distributed energy resources (DER) is continuing to accelerate. To ensure power system reliability and resilience, a distributed and reconfigurable communication system offers several advantages. Currently, the complex communications architecture of a grid-DER environment is transitioning from hard-wired communications infrastructure to 5G-based infrastructure. The implications of 5G for energy security and resilience are significant primarily due to the possible increase in grid disruptions that can be caused by the exponential increase in interconnected devices at the grid edge and the increasing dependence on software-based infrastructure. In this work, we are developing a simulation-based optimization framework for examining communications architecture configurations to simultaneously optimize power and communications systems metrics when operating in an adversarial environment. This mathematical framework leverages the unique capabilities of 5G communications --particularly 5G Core-based network slicing -- enabling functional and operational diversity across a common network infrastructure for improved DER coordination. A multi-objective reinforcement learning will characterize the power flow coupled with the communications network while also incorporating network slicing.

Following the presentations, an opportunity for participants to ask question of the panel will be provided.