

Complex Modeling Project for FirstEnergy Corp Results in Clear View of Bulk Electric and Sub-Transmission System

North American Electric Reliability Corporation's (NERC) Protection Relay and Control (PRC) regulation NERC PRC-027-1 calls for utilities to assess protection systems coordination for performance during faults. This requires utilities to collect and verify accurate transmission system information to prepare a comprehensive short circuit and protection model.

For FirstEnergy, one of the largest investor-owned utilities in the U.S., the NERC regulation also presented an opportunity to rectify potentially out-of-date relay settings records across its ten operating companies which serve more than six million customers. With up-to-date system-wide models, FirstEnergy gains a more accurate view of its bulk electric and sub-transmission system – allowing for effective system operations decisions based on precise impedance values and voltages. The result is better overall system coordination of settings and a reduction in potential relay miscoordinations during faults.

As utilities implement infrastructure upgrade projects over the course of several years, small increases to available fault current add up to create a gap in relay coordination and available fault current. If the cumulative effect results in a 15 percent or greater change in available fault current for the utility's bulk electric system, there is a high likelihood of protection miscoordination. A proactive approach to managing the transmission and protection model can help avoid misoperations of relays on the transmission system. This includes adhering to NERC PRC-027-1 regulations, capturing zones of protection (ZOPs) in transmission models, and performing area-wide coordination studies on the protection settings.

Leidos analyzed and modeled updated settings for FirstEnergy across 1,500 relays, covering power lines on both the bulk electric and sub-transmission system as well as transformer settings.

One of the modeling projects for this initiative hinged on a nine-month timeline that required Leidos to create an automated process for testing the relays. Leidos modeled the settings on approximately 600 relays for 300 transmission lines by automating the Schweitzer Engineering Laboratories (SEL) relays to populate standard trip equations into the ZOP and assigning contact logic to the relay so it would function when faults were placed in the model. This custom script reduced human performance error and increased efficiency when parsing trip equations for SEL relays. What would have formerly taken 30 minutes per relay now takes 2-3 seconds per relay.

Leidos created a master model of the data which removed duplicate entries and provided a seamless update to FirstEnergy. All settings are now available in PSS®CAPE where they can be used to run custom CAPE macros, generate reports detailing coordination of bulk electric system relays, and maintain a clear view of the FirstEnergy system.

With more than 70 years of experience in the utility industry, Leidos has a proven history of helping its clients successfully support new regulations and requirements. Leidos helps utilities develop and implement solutions to their unique challenges by evaluating existing systems, assessing where improvements need to be made, and developing solutions that are uniquely tailored to meeting the challenges that each utility faces.

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