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Summary:

Today's power grids are designed to withstand high-probability and low-impact events. Although low-probability faults are unlikely to cause significant losses to power networks, they can still have a significant economic impact. This work will develop integrated decision-making frameworks for resilience-driven investment and operational planning strategies. First, a set of linear formulations for evaluating complex distribution systems' nodal- and system-oriented resilience metrics while considering possible interruptions following predicted extreme events is extended. A resilience-oriented optimization tool is then introduced based on a stochastic mixed integer linear programming model for optimal line hardening and placement of switches/distributed generators. The proposed algebraic formulations will be incorporated into the planning problem to measure the overall distribution systems' resilience. In addition, the developed model will consider post-disaster restoration operations in resilience-oriented planning studies. It is expected that integrated optimization of infrastructure solutions and flexible resources will eventually reduce the need for bulk infrastructure enhancements or expansions. Multiobjective approaches are introduced to deal with conflicting objectives, i.e., investment cost, resilience, and reliability metrics, to facilitate decision-making for system operators and planners. The effectiveness of the proposed assessment and planning models is evaluated on the general standard test systems.