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Resiliency-driven strategies for power distribution system development

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Abstract-

Power system planning engineers aim to create a reliable, and efficient grid to meet load demand, while avoiding costly investments in advanced distribution technologies. Recent extreme weather and cyber events have exposed the vulnerability of the power grid and posed a new requirement for system resiliency, which denotes its ability to keep serving critical loads even with adverse events. Additionally, a push for integrating distributed energy resources provides multiple opportunities and challenges. The resiliency-driven planning strategies for system resources are still in their infancy, and more investigation is needed. This paper presents a systematic method for enabling highly resilient power distribution systems by suggesting strategies to utilize distributed energy resources and automated switches in efficient way. Topology-based and novel feasible-network-based scores are developed for resiliency measure and to guide selection of appropriate strategies given multiple options. Efficiency of the developed algorithm was substantiated on the modified IEEE 123 node system and provides the most resilient feasible network. The proposed algorithm can be employed by power system engineers for resiliency-driven planning and system upgrades.

Index Terms- Resiliency; Distribution system planning; Graph theory; Distributed energy resources; Automated switches; Analytic hierarchy process

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