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Coordinating network reconfiguration and local flexibility markets under alternative governance models for congestion management

M. Valarezo Rivera; T. Gómez San Román; J.P. Chaves Ávila

Abstract-

This paper introduces two governance models to coordinate Distribution Network Reconfiguration (DNR) with Local Flexibility Markets (LFMs) for congestion management in active distribution networks. The models are designed to reflect the main LFM operator arrangements emerging in European regulatory frameworks and practical implementations, where the local market operator role may be assigned either to the procuring Distribution System Operator (DSO) or to an independent third-party platform. The first model represents a DSO-operated LFM, enabling an integrated co-optimization of network topology and flexibility procurement. The second model represents a third-party-operated LFM, leading to a sequential coordination scheme in which the DSO first determines the network reconfiguration and then procures flexibility through the external market platform. Unlike existing studies that address DNR and market-based flexibility as separate processes, the proposed framework explicitly captures their operational interdependence by modeling how network reconfiguration dynamically affects the eligibility and participation of flexibility service providers (FSPs). A detailed case study evaluates both models under varying levels of load growth and flexibility availability. The results show that when flexibility resources are fully available, both DNR-LFM governance models eliminate all network constraints and converge to the same optimal topology with minimal operational cost. Under reduced flexibility availability, however, the co-optimization model maintains secure operation and zero Expected Energy Not Supplied, whereas the sequential model leaves residual unserved energy and incurs higher costs. These findings highlight the critical influence of the governance structure, information exchange, and FSPs availability and location on the efficiency of the DNR–LFM coordination, offering valuable insights for future regulatory frameworks promoting market-based flexibility procurement.

Index Terms- Distribution network reconfiguration; Congestion management; Local flexibility market; Third-party flexibility; Topology optimization

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