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Demand Response and Electric Vehicles as Services to Provide Support to the Distribution Network Operation

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Summary

Nowadays, the current power systems, particularly the low voltage distribution networks, have undergone significant modifications. The growing trend of power generation by renewable sources and electric vehicles has posed new challenges and new opportunities. Furthermore, the widespread use of "smart meters" and the desire to include citizens as key players in future energy markets and system operations enhances the distribution system operator's role. Therefore, creating new and innovative techniques to investigate the possibility of mechanisms for delivering services in distribution networks, particularly at low voltage levels, becomes crucial. This paper proposes an innovative methodology based on a logic heuristic method for enhancing small customer demand response participation and public and home charging stations for electric vehicles as provided services in low voltage distribution networks to relieve voltage and congestion issues. A realistic low voltage distribution network with 236 buses is employed to demonstrate the proposed model's applicability. The results show significant improvements in the voltage profile and congestion.

Highlights

- Voltage and congestion problems mitigation in distribution low voltage networks through the flexibility of demand response services participation of small consumers and electric vehicles charge stations as provided services.
- A logic heuristic model working together with MATPOWER, an electric power system simulation, and analysis, is used.
- Three case studies were considered and compared to a reference case (no demand response services).
- Even when not all traditional consumers are willing to join a demand response service, the network's problems are solved.

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