

# **Distributed battery energy storage systems for deferring distribution network reinforcements under sustained load growth scenarios**

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## **Abstract-**

Energy storage systems can be leveraged in electricity distribution network planning as mitigation alternatives to traditional grid reinforcements if they are strategically installed and operated to reduce congestion and voltage limit violations. This paper examines the technical and economic viability of distributed battery energy storage systems owned by the system operator as an alternative to distribution network reinforcements. The case study analyzes the installation of battery energy storage systems in a real 500-bus Spanish medium voltage grid under sustained load growth scenarios. The results show that, in general, dedicated battery energy storage systems are only a cost-efficient alternative in distribution system planning under very specific conditions, such as when low load growth rates are expected. Nevertheless, they are only required for peak shaving a few days per year. For the analyzed case study, the recoverable portion of their total cost through deferral of distribution system upgrades is higher than the fraction of cycles required for peak shaving under all sustained load growth scenarios. Therefore, it is also explored if mobile battery energy storage systems, capital grants, and revenue stacking can enable battery energy storage systems to become an efficient distribution system planning alternative.

**Index Terms-** Distribution network planning; Energy storage systems; Reinforcements; Genetic algorithms

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