

ABSTRAK

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Judul : Analisis EV Hosting Capacity Pada Sistem Distribusi 20 kV
Yang Terisolasi Menggunakan Quasi-Dynamic Simulation
(QDS)

Abstrak — Perkembangan kendaraan listrik (*Electric Vehicle*/EV) yang semakin pesat diperkirakan akan meningkatkan kebutuhan energi listrik dan memberikan tambahan beban pada jaringan distribusi. Kondisi tersebut menjadi tantangan tersendiri bagi sistem distribusi 20 kV yang terisolasi karena memiliki kapasitas pembangkitan dan fleksibilitas operasi yang terbatas. Oleh karena itu, diperlukan analisis *EV Hosting Capacity* (HC) untuk mengetahui kemampuan maksimum jaringan dalam mengakomodasi beban pengisian kendaraan listrik tanpa melanggar batasan teknis sistem. Penelitian ini bertujuan menganalisis pengaruh pengisian daya EV secara *uncoordinated charging* terhadap profil tegangan, pembebanan jaringan, interval waktu kritis, serta menentukan nilai *EV Hosting Capacity* pada sistem distribusi 20 kV terisolasi. Penelitian dilakukan menggunakan DIgSILENT PowerFactory dengan metode *Quasi-Dynamic Simulation* (QDS) selama 24 jam berdasarkan profil beban harian dan profil pengisian EV. Analisis dilakukan pada dua skenario distribusi beban EV, yaitu *uniform* dan *distributed*, dengan mempertimbangkan batasan tegangan dan pembebanan termal. Hasil penelitian menunjukkan bahwa penambahan beban EV menyebabkan penurunan profil tegangan serta peningkatan pembebanan saluran dan transformator. Interval operasi paling kritis terjadi pada pukul 19.00, ketika beban sistem dan pengisian EV mencapai kondisi tertinggi. Nilai *EV Hosting Capacity* yang diperoleh sebesar 952 unit EV (6,8544 MW) pada skenario *uniform* dan 901 unit EV (6,4872 MW) pada skenario *distributed*. Hasil penelitian menunjukkan bahwa batas tegangan menjadi faktor pembatas utama dalam penentuan kapasitas *hosting* dibandingkan batas pembebanan termal.

Kata Kunci: *Electric Vehicle*, *Hosting Capacity*, *Quasi-Dynamic Simulation*, Sistem Distribusi Terisolasi, *Uncoordinated Charging*.

ABSTRACT

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Abstract — The rapid growth of electric vehicles (EVs) is expected to increase electricity demand and impose additional loading on distribution networks. This condition poses a significant challenge for isolated 20 kV distribution systems due to their limited generation capacity and operational flexibility. Therefore, an Electric Vehicle Hosting Capacity (EVHC) assessment is required to determine the maximum EV charging load that can be accommodated without violating the network's technical constraints. This study aims to analyze the impact of uncoordinated EV charging on the voltage profile, network loading, critical operating intervals, and the EV Hosting Capacity of an isolated 20 kV distribution system. The analysis was conducted using DIgSILENT PowerFactory with the Quasi-Dynamic Simulation (QDS) method over a 24-hour period based on daily load and EV charging profiles. Two EV load allocation scenarios were evaluated, namely uniform and distributed, while considering voltage and thermal loading constraints. The results indicate that increasing EV charging demand leads to voltage degradation and increased loading of distribution lines and transformers. The most critical operating interval occurs at 19:00, when the system load and EV charging demand simultaneously reach their highest levels. The maximum EV Hosting Capacity obtained is 952 EV units (6.8544 MW) under the uniform scenario and 901 EV units (6.4872 MW) under the distributed scenario. The findings demonstrate that the voltage constraint is the primary limiting factor in determining the hosting capacity, whereas the thermal loading constraint remains within the allowable operating limits.

Keyword: *Electric Vehicle, Hosting Capacity, Isolated Grid, Quasi-Dynamic Simulation, Uncoordinated Charging.*