

An Equity-Aware Residential EV Charging Control

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The shift towards electric vehicles (EVs) in the near future is undeniable. With the integration of EVs, rising charging demands pose voltage challenges to the distribution grid. The voltage-based controlled EV charging proposed by the existing literature to manage the distribution system voltages usually has inherent locational disadvantages and can lead to inequitable or unfair EV charging. This paper proposes *EqV-Volt* charging control, which is an equity-aware, var-supported, voltage-based local EV charging control with no communication requirements. It uses a small percent of bi-directional charger capacity to provide var support to local point-of-charge voltage, and the EV is charged with the maximum possible charging power. The proposed charging control combines volt/watt and volt/var control based on local voltage feedback. A mathematical model of control is formulated, and its stability analysis, along with the model validation, is provided. A charging equity index is introduced to quantify equity awareness of charging control. The proposed control provides fair EV charging and keeps system voltage within stability limits. Validation is provided through multi-day phasor simulations in MATLAB/Simulink on a modified IEEE 33-bus system with 1440 EVs.