University of Paderborn

NEK Institute

Doctoral Thesis Subject

**Applying Smart Management System for EVs in Power Networks using Smart Grid capabilities**

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***Abstract***

Power system stability and security is becoming recently a challenging issue due to the high penetration of renewable energies in power production like wind and solar regarding their unpredictable nature. Furthermore, the presence of Electric Vehicles (EVs) in the near future in households is inevitable as the EVs worldwide popularity is growing. In this Doctoral thesis, a smart control method is proposed for the plugged-in EVs charging and discharging procedure applying smart grid capabilities. Essential grid operation constraints including overload occurrence prevention, Loss reduction and market energy prices tracking are taken into account. The proposed control method is evaluated in a distribution network and a modified micro-grid in the MATLAB environment. Real data of users driving behaviors utilized from performed studies is applied into the model to obtain realistic results. Different worst case scenarios are derived in a day time horizon to show the effectiveness of this smart charging and discharging method. The results demonstrate the positive impact of this methodology in saving operational costs and increasing system stability.

**Keywords:** V2G, Smart Controlling Management System, Micro-grids, Real User’s Driving Patterns, Renewable Energies, Frequency Control, Grid Stability Constraints