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Evaluation of aggregate models of plug-in electric vehicles for primary frequency control

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Abstract-

This paper summarizes and evaluates in detail aggregate models of plug-in electric vehicles (PEVs) for primary frequency control (PFC) through dynamic simulations. A basic aggregate model of PEVs for PFC is introduced and then gradually developed in the following steps: i) technical characteristics of PEVs are incorporated into the model, ii) technical characteristics of distribution networks are formulated and added, and iii) a strategy is described to well-design the frequency-droop controller of PEVs for PFC. Moreover, from an economic point of view, a method is presented to assess the benefits which could result from PEVs for PFC. Four simulation scenarios are defined to evaluate the impact of: 1) different PEV’s penetration levels, 2) PEV’s operating modes and constraints, 3) power consumed in the network during the PFC, and 4) well-designed frequency droop controller, on the frequency response following a contingency event. Simulation results show that aggregate PEVs have a great potential not only to improve the frequency response, while preserving the overall stability, but also to save some costs associated with PFC.

Index Terms- Aggregation, Distribution Networks, Economic Assessment, Plug-in ElectricVehicles, Primary Frequency Control, Strategy, Technical Constraints,Well-Design Droop.

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