Preface

Plug in Electric Vehicles (PEVs) use energy storages usually in the form of battery banks that are designed to be recharged using utility grid power. One category of PEVs are Electric Vehicles (EVs) without an Internal-Combustion (IC) engine where the energy stored in the battery bank is the only source of power to drive the vehicle. These are also referred as Battery Electric Vehicles (BEVs). The second category of PEVs, which is more commercialized than the EVs, is Plug in Hybrid Electric Vehicles (PHEVs) where the role of the energy storage is to supplement the power produced by the IC engine. These two types of PEVs are predicted to dominate the automobile market by 2030. Widespread adoption of PEVs allows the world to reduce carbon emissions in transportation needs significantly. Therefore, it is vital to the success of a collective global effort in meeting the climate energy targets and to reduce the dependence on increasingly scarce fossil fuels. However, significant challenges are thrust upon the utility grid operators on how best to manage the power demand arising due to the charging of PEVs by the grid (G2V) and the power supply due to the Vehicle to Grid (V2G) discharging of energy storages in PEVs.

This book covers the recent research advancements in the area of energy management that can be employed to accommodate the anticipated high deployment of Plug-in Electric Vehicles (PEVs) in smart grids. The topics that are covered in this book include smart coordination based on real-time pricing, decentralized demand side management, optimal and distributed control of both G2V and V2G modes of PEVs, minimizing the energy procurement cost and financial risks in an energy hub, voltage droop controller with an event-driven control strategy for the coordination of charging PEVs, Additive Increase Multiplicative Decrease to control both the active and reactive power consumption and injection in the smart grid, an optimal controller to maximize profit based on a novel dynamic model of the system, aggregator bidding into the day-ahead electricity market with the objective of minimizing charging costs, optimal operation of plug-in vehicle fleets in a microgrid characterized by the presence of other distributed resources and a mixed integer linear programming energy management optimization model to schedule the charging and discharging times of PEVs. Hence, this book introduces many new strategies proposed recently by researchers around the world to address the energy management of smart grids with high penetration of PEVs. The book is aimed at engineers, system planners, energy market operators, researchers, and graduate students, who are interested in the latest developments in this field of research.

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