A Smart Grid for Electric Vehicles

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Abstract

Electric vehicles represent a promising future in terms of decreasing CO2 emission and reliance on fossil fuels. China has attached great importance to electric vehicles. By 2015, China will have 500,000 BEVs and PHEVs on road. Large-scale electric vehicles will impact the power grid in some extent. The recharging of EVs may overload the local electrical equipment and increase the peak load significantly which burdens the limited peak capacity. The smart grid and electric vehicles have the same aim for more clean and efficient energy consumption.

The batteries on electric vehicles can either provide power to the grid or consume power from the grid, known as the vehicle-to-grid (V2G) concept. As vehicles are parked most time, it is possible to use electric vehicles to improve the efficiency of power system when they achieve a considerable market penetration. The aggregated power of electric vehicles can be used for load shaping, ancillary services and supporting fluctuating renewable generation in the smart grid scope. The integration of electric vehicles in power system is the common understanding of smart grid strategy makers. It is difficult to control numerous electric vehicles because they are distributed in the load side and the capacity is hard to estimate for the randomness of plug-in time, depth of discharge etc. The paper will discuss the technologies needed for the integration of electric vehicles, including communication, control devices and the management system. A conceptual structure of the management system is proposed. According to the real-time grid operating situation, the system will decide the power direction and magnitude with the permission of electric vehicle users.

Charging infrastructure is the basic of electric vehicles. The integration of electric vehicle should be considered in the current charging infrastructure construction, as the conversion will be more difficult. And the related standardization work has commenced in the ISO/IEC joint workgroup. The paper will discuss the considerations in the initial stage of electric vehicles and the steps to promote the synchronous development of electric vehicles and smart grid.