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An efficient way to manage the charge of electric vehicles to increase reliability

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Abstract

An electric vehicle (EV) is an automotive vehicle that uses one or more electric motors for propulsion. It can be powered by a collector system, with electricity from extravehicular sources, or it can be powered autonomously by a battery (sometimes charged by solar panels, or by converting fuel to electricity using fuel cells or a generator). EVs include, but are not limited to, road and rail vehicles, surface and underwater vessels, electric aircraft and electric spacecraft. This study summarizes a critical review on EVs' optimal charging and scheduling under dynamic pricing schemes. A detailed comparison of these schemes, namely, Real Time Pricing (RTP), Time of Use (ToU), Critical Peak Pricing (CPP), and Peak Time Rebates (PTR), is presented. Globally, the intention is to reduce the carbon emissions (CO2) has motivated the extensive practice of Electric Vehicles (EVs). The uncoordinated charging and uncontrolled integration however of EVs to the distribution network deteriorates the system performance in terms of power quality issues. Therefore, the EVs' charging activity can be coordinated by dynamic electricity pricing, which can influence the charging activities of the EVs customers by offering flexible pricing at different demands. Recently, with developments in technology and control schemes, the RTP scheme offers more promise compared to the other types of tariff because of the greater flexibility for EVs' customers to adjust their demands. It however involves higher degree of billing instability, which may influence the customer's confidence. In addition, the RTP scheme needs a robust intelligent automation system to improve the customer's feedback to time varying prices. In addition, the review covers the main optimization methods employed in a dynamic pricing environment to achieve objectives such as power loss and electricity cost minimization, peak load reduction, voltage regulation, distribution infrastructure overloading minimization, etc.

Keywords: electric vehicle; distribution network; scheduled charging; optimal operation; dynamic pricing; power grid.