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电力系统

电动汽车充电功率需求的统计学建模方法

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摘要：

电动汽车规模化应用后，其充电功率需求将对电网产生一定影响。本文分析了与电动汽车功率需求相关的各种因素，在一定假设条件下，根据燃油车的统计数据，考虑了部分随机因素的概率分布，建立了电动汽车功率需求的统计模型。本文用蒙特卡罗仿真方法求得单台电动汽车功率需求的期望和标准差，进而给出多台电动汽车总体功率需求的计算方法。本文最后以北京市和上海市夏季某日负荷曲线为例，计算得出不同规模电动汽车对原负荷曲线的影响。计算结果表明，电动汽车的自然充电特性将使电网最大负荷发生一定增长。本文建立的统计模型为研究电动汽车对电网的影响提供了基础，也为电动汽车充电管理策略的设计提供了依据。

关键词：

A Statistical Model for Charging Power Demand of Electric Vehicles

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Abstract:

Electric vehicles represent a promising future in terms of decreasing CO2 emission and reliance on fossil fuels. Electric vehicles get energy for driving from power grid through charging facilities. There is a valid concern that numerous electric vehicles charging will impact grid reliability and peak demand. It is critical to find out the natural coincidence between the original peak electricity demand and the hours during which electric vehicles are plugged in. The power demand of electric vehicles follows some probability distribution with the randomness of plug-in time, depth of distance，charging power etc. This paper aimed to propose a method to calculate the probabilistic of power demand in time scale. Driving data of conventional internal combustion vehicles was used to estimate the possible feature of electric vehicles. A statistical method was provided to model the aggregated power demand for electric vehicles with several critical stochastic factors considered. And Mont Carlo simulation was used to get the statistical values of power demand during one day. For instance, the additional power demand from varying levels of electric vehicles penetration was added to the load curves on a summer day in two cities of China. The natural charging scenarios indicate that the charging needs of electric vehicles increase the peak demand of power grid. It is suggested to optimize electric vehicle charging through smart grid technologies and demand-side management. This paper is a basic work to assess the impacts of electric vehicle charging on power grid. This paper also provides basis to design the control strategies for electric vehicles charging management.

Keywords:

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