新能源与分布式发电

风光储联合发电系统储能容量对有功功率的影响及评价指标

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摘要：

风力发电和太阳能光伏发电均具有随机功率波动特性，风光储联合发电系统可以利用风力发电和太阳能光伏发电的互补性，应用储能技术平抑有功功率波动，提高电能质量，减少对电网的冲击。风力发电、太阳能光伏发电以及储能的技术特性、容量配置及控制策略对联合发电系统的总有功功率特性有重要影响。本文分析了风光储联合发电系统的结构特点、数学模型和技术特点，提出了一种储能单元充放电优化模型，该模型以有功功率波动最小为目标函数，其约束条件计及每个步长的储能初始容量和储能充放电控制策略。在此模型基础上，本文提出了衡量风光储联合发电系统的有功功率波动的三个指标α,β,γ，并结合部分文献常用的评价风光储联合系统供电可靠性LPSP、EXC指标，综合评价总输出功率特性，最后通过matlab编程进行了实例验算，分析了有功功率特性随储能容量配置方案的变化趋势及各指标的指导作用。

关键词： 风力发电　太阳能光伏发电　储能技术　容量配置　有功功率特性　有功功率波动指标

Impacts of Energy Storage Capacity Configuration of HPWS to Active Power Characteristics and Its Relevant indices

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Abstract:

The common characteristic of solar energy and wind power are the low energy density and the strong randomness, and Hybrid Photovoltaic/Wind Power Generation System with Storage Bank (HPWS) is a new form of power generation unit which use the complementation of characteristics of wind, photovoltaic generation system, along with energy storage, can decrease the fluctuation of active power in a hybrid system, improve power quality and reduce the impact to power system. Characteristics and capacity configurations of wind power, photovoltaic system and energy storage have a significant effect on active power output characteristics in a hybrid system. Starting with a summary of the typical structure, the representative modals and technical characteristic of HPWS, this paper further designs an optimization model of battery storage unit about charging and discharging, and assigns the minimum fluctuation of active power as the optimum objective function ,a new concept of initial capacity of battery storage in each step and a control policy for charging and discharging as the constraint condition. Based on the model, three evaluation indexes of the active power fluctuation of HPWS are put forward, combined with two indexes LPSP, EXC, which are commonly used to measure the system reliability, moreover, the five indicators can be used to appraise the total output power characteristics comprehensively. Finally, the paper use the Matlab programming to analyze the change tendencies of output power with the battery capacity and the guide role of the indexes for determining the optimum size of a HPWS.

Keywords: wind power generation　solar PV generation　energy storage technology capacity configuration　active power characteristics　indices of fluctuation of active power

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