基于氢储能的风电系统功率协调策略研究

摘　要

由于风力变化难以预测，大容量不稳定的风电进入电网会造成电网电压波动大，我国弃风问题影响了风电的进一步发展。针对风力发电不稳定和并网严重弃风问题，为了减少电网电压波动，提出了基于氢储能的风电系统协调研究。

氢作为被广泛利用的清洁能源，具有把化学能转化为电能的优点；储能技术结构简单，安装成本低、并且反应能力迅速。通过风电制氢及氢储能技术能够合理的缓解并网中出现的波动问题、进而提高系统稳定性，减少风能的浪费。风氢耦合系统主要有双馈风力发电机系统与氢储能系统，风电通过进行电解槽电解，将电能转化为化学能进行储存。通过在通过 Matlab/Simulink 软件中搭建系统仿真模型，验证了建模的合理性以及风氢耦合系统经济性分析，通过仿真程序对不同功率匹配模式下的小规模风电系统电解制氢展开研究，其次，考虑了经济性因素和以及运算成本，对制氢系统进行了评估，即以平准化电力成本为指标，在不同季节，不同风机塔高度和不同风速等多种情况下，对风电制氢系统进行了具体的经济性评估。

关键词：储能技术；风电系统；风氢耦合；经济性

ABSTRACT

Due to unpredictable wind changes，large-scale unstable wind power entering the power grid will cause large voltage fluctuations in the power grid， and the serious"abandonment of wind problem in China has hindered the further development of wind power． Aiming at the problems of wind power generation fluctuations and serious grid abandonment，in order to reduce grid voltage fluctuations，a coordinated study of wind energy systems based on hydrogen energy storage was proposed．

Aiming at the problem of the power fluctuations of wind power generation and severe grid abandonment， a coordinated study of wind power system based on hydrogen energy storage was proposed． Hydrogen， as a widely used clean energy source， has the advantage of converting chemical energy into electrical energy； energy storage technology is easy to install，flexible in capacity configuration，and has a quick response capability．Wind power generation and hydrogen storage technology can effectively suppress wind power fluctuations， improve the quality of wind power grid connection， and then reduce the wind curtailment rate． The wind-hydrogen coupling system mainly includes a double-fed wind generator system and a hydrogen energy storage system．When wind energy flows to the energy storage，electrolyze the electrolyzer to convert electrical energy into chemical energy for storage．By building a system simulation model in Matlab / Simulink software， he rationality of the modeling and the economic analysis of the wind-hydrogen coupling system is verified， and the simulation program is used to conduct research on the electrolytic hydrogen production of small-scale wind power systems under different power matching modes．Specific economic analysis which was based on the level cost of electricity on this system was necessarily introduced due to several different environmental conditions， such as hub height， wind speed and seasonal reasons were all considered in the following stage．

Keywords： Energy storage technology； wind power system； wind-hydrogen coupling； economy