Grey Prediction Theory for Clean Energy Matrix in China: Recent Developments and Challenges

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Overview

The investment and research of clean energy (CE) resources has gained extensive interest in the world. The clean energy, not only includes renewable energy like solar, wind, geothermal, and biofuels, but also contains "clean" fossil fuels like coalbed methane and natural gas. A rising awareness of energy and environmental issues, due to the highly consumption of fossil fuels, is propelling both developing and developed countries to exploit CE resources. And the utilization of CE has become a strategic mission in many countries in order to mitigate the reliance on fossil fuels and diminish pollution. China, as one of the largest energy consumers and importers in the world, due to its distinct resource endowment and growing energy demand, is facing severe challenges for energy shortage and environmental pollution simultaneously. According to government statistics, the total primary energy consumption of China was 4.26 billion tonnes of coal equivalent during financial year 2014-2015. Among the total primary energy, 83% are from coal and petroleum, which has caused terrible air pollution and oil import dependence. Nearly 60% of petroleum consumption depends on import in 2015 and the percentage of petroleum import will reach 80% by the end of 2030. The emissions of CO_2 had reached 10.3 billion tonnes in 2015, which was thirty percent of the world's total CO_2 emissions, and caused serious atmosphere pollutions in the northern China. Therefore, the Chinese Government attaches great importance to the exploitation of CE resources, which are regard as the key element to alleviate air pollution and realize "energy independence". In 2015, National Development and Reform Commission of China issued the High Renewable Energy Penetration Scenario and Roadmap Study in the following sectors: solar, wind, hydropower, biomass, geothermal and nuclear. The objective of this report is to reach the goal of 85.8% of total electricity demand being satisfied from renewable energy resources by 2050. In 2017, the Chinese government issued the Cleaning and Heating Planning in the Northern China (2017-2021). According to the planning, the northern cities, which are suffering serious air pollution, will gradually make use of solar, natural gas, biomass for heating instead of coal heating in the next five years. The percentage of clean energy for heating will reach 70%, which will replace 150 million tonnes coal heating. To realize the ambitious target of Planning, a comprehensive analysis of CE resources based on the special national conditions is necessary. The intension of this study is to evaluate different CE resources and CE policies in China, and puts forward some effective suggestions.

Methods

Grey prediction theory was applied to evaluation for CE prospects in China. This study conducted an empirical study of clean energy resources and policies in China. By analysing the energy consumption data from government database, this study reviewed the evolving trajectory of clean energy exploitation over the period of 2006-2016 and predicted the future shortage of realizing the CE mission with the grey theory. Finally, this study offered some advices with regarding to decision-making processes behind the CE programs.

Results

This examination allowed us to reveal the necessity and difficulty of CE exploitation in China. According to the prediction results by grey theory, the CE requirement will reach 1.5 billion tonnes of coal equivalent by 2025 and will be 20% percent of total primary energy consumption, which is a ambitious challenge. Although many CE development programs have been published by Chinese government at all levels and are proved to benefit the ecological environment and energy security, the research results also illustrates some hidden dangers. In China, government leaders at low levels often formulate policies for placating their overseers in Beijing instead of scientific evaluation independently, which has caused enomous waste of resources and protest from the citizens.

Conclusions

This study not only conducted the challenges and possibility to realize the CE planning made by Chinese government, but also revealed the dominant influence because of command-and-control policies on the clean energy exploitation. Therefore, instead of focusing only on the CE replacement target in the next five, ten and thirty years, we should also examine the historical policy environment in which the CE programs are embedded.

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