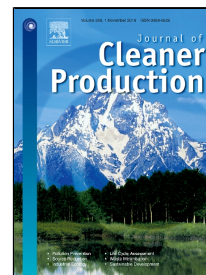


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The cost and marketability of renewable energy after power market reform in China: A review

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Highlights

- The power market deregulation reform in China is reviewed.
- The power generation cost hierarchy and allocation in China are reviewed.
- The renewable energy pricing mechanism in China is analyzed.
- The obstacles of marketability of renewable energy in China are identified.
- The feasibility of a market-premium-like regime in China is discussed.

Abstract: The renewable energies of China have been through a fast-developing process for about ten years. But they suffer from curtailment in recent years, especially for wind and photovoltaic. China started a new power market reform in 2015, featured by the establishment of electricity wholesale market. Whether the deregulated power market will help renewable energy penetration has become a hot topic. This paper aims to review the cost and marketability of renewable energy before and after power market reform in China so as to provide suggestions and inspirations for the field. A review approach based on literature classification and analysis of selected studies is utilized for argumentative review. The main work of this paper is as follows. 1) Generation and integration costs of renewable energy are analyzed through empirical data and comparison. 2) Current cost allocation of power generation in China is analyzed. 3) The marketability of renewable energy is discussed. 4) This paper comes with a conclusion that the major obstacles for renewable energy marketability lie in the non-independence of the system operator, the faultiness of the market mechanism (thus the distortion of cost allocation) and the history problem of the power structure. 5) A market-premium-like regime is suggested for relieving these obstacles. The conclusions and suggestions can be helpful for further research and policy making.

Keywords: renewable energy; cost allocation; renewable energy marketability; electricity market; market reform;

1. Introduction

Since the establishment of *Renewable Energy Law*, renewable energy (RE) in China has experienced a rapid growth. In 2016, the incremental installed capacity and the cumulative installed capacity of wind reached 23GW and 169GW respectively, while the numbers of photovoltaic (PV) power were 35GW and 77GW in China (NEA, 2017). In contrast to the high-speed development of installed capacity, renewable energy generated power (REGP) has gone through a severe curtailment. With the promulgation of *Opinions for Further Reformation on Electric Power Industry (No.9 document)* by the State Council in 2015 (Council, 2015b), China's electricity market starts a process of deregulation. So, is it possible to increase RE penetration rate by the participation of REGP in the electricity market? The issue is related to the generation cost, integration cost, and the marketability of RE.

Levelized costs of electricity (LCOE) is a metric that has been widely employed to compare generation costs for different power generation technologies. It calculates the whole life-cycle cost of a power generation project based on discounted cash flow (DCF) method. In the calculation, it is necessary to make assumptions about the project life cycle, full-load hours and some other parameters (IEA, 2015). LCOE has been employed in many researches, mainly involving analyses of REGP breakeven price, roadmap evolution and price policies. (Levitt et al., 2011) carry out the calculation of the LCOE of US offshore wind and the breakeven price required for financial viability. Hernández-Moro and Martínez-Duart (2013) establish evolutionary

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