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Editorial: Economics and policies in formulating renewable power development plans

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Editorial on the Research Topic

[Economics and policies in formulating renewable power development plans](#)

Introduction

Energy production is considered as the pillar of the national security and foundation of the economy (Li and Wang). Fossil fuel consumption leads to serious climate change and environmental pollution issues that results from carbon emissions and pollutants. Hence, renewable energy has been considered as an effective way to ameliorate these issues. Multiple international organizations such as the Intergovernmental Panel on Climate Change (IPCC) have invested a lot of effort to coordinate the benefits of countries. However, several countries, including developed and developing countries, have initiated certain policies to mitigate climate change and reduce carbon emissions. Consequently, increasing preferential policies are being formulated to accelerate the development of renewable power (Zhu and Jin). Energy security affected by the bottleneck of crude oil supply and the global issues ensuing from the fossil energy consumption are two compelling reasons for the rapid development of renewable energy (Liu et al.). In the past decades, the share of renewable energy in the energy mix has been steadily increasing, which indicates that the development and utilization of renewable energy has become the consensus policy of several nations.

In this perspective, this Research Topic intends to investigate the factors affecting the development of renewable power, and explore the optimal pathway for different economies, which may provide countermeasures and suggestions for academic research and policy drafts. This paper will introduce the contributions made by the accepted papers from three viewpoints, *viz.*, the development path of renewable power, the incentivizing factors, and the obstacles to the development of renewable power.

Discussions on the development path

Energy transformation is a difficult issue encountered by all countries. The critical concern is to explore the optimal development path for renewable power development. There are several studies focusing on the gradual goals of the transformation and upgrading of China's power industry, in which the conditions of technical judgment, specific profile, and moderate agenda have been incorporated [Lu et al.](#) The achievement of the energy-saving and emission reduction goals is a gradual pathway instead of a single stroke accomplishment. [Xu et al. \(2020\)](#) explored the optimal development path of China's solar photovoltaic power during the period 2018–2050, and found that the development goals set by governments can be achieved under different scenarios. Of course, all studies do not arrive at the same conclusion. [Zhang X. et al.](#) analyzed the optimal development path of Concentrated Solar Power (CSP), and found that the government cannot not achieve the target for the cumulative installed capacity by 2050.

Besides the domestic analysis, the international experience can also shed light on the development of the renewable power for a country. A comparative study of the international renewable power development paths can offer us certain suggestions, though the countries may vary in development paths owing to the differences in the resources and environment. Numerous studies have discussed the development path of the renewable energy from an international perspective. The examples include research on the relationship between renewable energy development and carbon emission efficiency in developed countries ([Dong et al., 2022](#)), and research on the long-term equilibrium nexus between renewable energy development and economic growth in European countries ([Kasperowicz et al., 2020](#)). [Lan et al.](#) measured the efficiency of China's green investment in the Belt and Road countries from 2011 to 2018 from both the static and dynamic perspectives, and provide an in-depth analysis regarding the differences, changes, and influential factors in the regional coordination of industries with the environment.

Analysis of the factors that incentivize renewable power development

Policy and regulation have always been an important factor in boosting the development of renewable power. To mitigate climate change and cope with the energy shortage, many countries around the world have formulated a series of policies to strengthen investment in research and development. The experience in related fields may tremendously benefit the development of renewable power ([Dou et al.](#)). Three papers in this Research Topic discuss their impacts on renewable power, including the combined game of subsidy and penalty policy, carbon quota policy, and subsidy policy for electric vehicles.

Subsidies and penalties are the two main regulation methods adopted by authorities to promote the development of renewable

power. Many challenges, such as subsidy fraud and effectiveness exist while adjusting the policies. [Dou et al.](#) incorporated the subsidy and penalty policies into a sequential game theory model to explore the impact of the different regulatory mechanisms on the promotion of renewable energy. The findings demonstrate that higher fines or profits from the legal production are more likely to stimulate renewable power production than the subsidies. [Zhu and Jin](#) focused on the impact of the carbon quota on enterprises in implementing the efficiency power plant (EPP). [Liu and Wang](#) estimated the impact of the different subsidy policy intensities on the change in consumer demand for EVs, obtains the corresponding subsidy policy agent response and treatment effect, and proposes corresponding policy optimization countermeasures and suggestions. According to those results, the study proposes reasonable suggestions, including the supervising subsidies, the adoption of incentive regulations, and the design of a targeted regulatory mechanism.

The development of renewable power has been influenced by several other factors besides policy measures. Along with the analysis of the optimal development path of CSP, [Zhang X. et al.](#) discussed the impact of the factors such as Gross Domestic Product (GDP) growth, incentive policies, technological advances, grid absorptive capacity, and emission regulation schemes on the development of CSP generation. [Mu et al.](#) focused on the analysis of the relationship between China's photovoltaic development and grid parity. [Li and Wang](#) focused on the analysis of the impact of the public environmental concerns on green innovation in China's automobile industry.

Analysis of the obstacles to the development path

There are also several obstacles that hinder the development of renewable power, and the most important one is the unbalanced resource distribution and power consumption. The uneven distribution between the resources and electricity load has resulted in an increasing curtailment of the renewable energy source, which strengthens environmental pollution ([Tan et al., 2020](#)). [Liu et al.](#) explored the issue of unbalanced energy development in China and analyzed the impact of the regional energy development levels on the high-quality economic development in China, from 2016 to 2017. [Liu et al.](#) considered that it is necessary to evaluate the level of energy development in different regions and explore the policies and measures to adjust the energy structure. Accordingly, this is the only way to solve the issue of unbalanced regional energy development, and hence, to realize the coordinated development of renewable power and economy in different regions. The same result was confirmed by [Zhang Y. et al. \(2021b\)](#).

Power load shifting is considered as a critical approach to boost the development of renewable power as it can effectively

counteract the intermittent characteristic of wind power and solar power. Zhang et al. systematically calculated the peak power load and the demand for gas-fired power generation capacity in China. They made theoretical contributions for applying the cooperative game model to overcome this difficulty.

Conclusion

The papers published in this Research Topic illustrate an in-depth understanding and fresh perspectives on the renewable power development path, influencing factors, and obstacles. This is intended for employing a set of quantitative models, such as the SBM-undesirable model (Lan et al.), learning curve model, technology diffusion model (Zhang X. et al.), structural equation model (Liu et al.), and sequential game theory model (Dou et al.). We believe that these studies can replenish the existing literature and contribute to the understanding and response of the policy makers on renewable power development. Furthermore, it provides a reference for us to study the development of renewable power from an international perspective (Zhang et al.). These papers develop the theories of renewable power in terms of the model, and offers several reasonable development suggestions with respect to practice.

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Author contributions

B-CX, H-ZL, KA, and XT contributed to conception and design of the study. BL wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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