Analyzing the Mechanism of Decentralized Energy Governance Strategy to Reduce Carbon Emissions: Evidence from China

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EXECUTIVE SUMMARY

1. Motivations underlying the research

Transitioning to renewable energy is crucial to reducing carbon emissions and achieving the Sustainable Development Goals, as renewable energy is cleaner, more efficient, and inexhaustible. However, due to heterogeneous regional development in energy transition, selecting appropriate governance strategies poses a complex challenge for central governments. Decentralized energy governance (DEG) strategies may provide a potential solution for this issue. A DEG strategy is a decentralized governance strategy in which the central government delegates the responsibility of environmental management to local governments.

Study on renewable energy governance contains several limitations and gaps that motivate our study. Current studies on renewable energy policies primarily focus on evaluating the effects of centralized energy policies. This approach, however, overlooks the impact of local renewable energy distribution on the development of renewable sources. Some studies examine the effect of China's DEG strategy on carbon emissions, although the mechanism of this strategy has not been comprehensively analyzed. Additionally, considering the heterogeneity of local government capacities at the regional level, the effects of the DEG strategy on local carbon emissions are not entirely clear.

To address this study gap, we examine two questions. First, what is the impact of the DEG strategy on reducing carbon emissions? Second, what are the mechanisms of impact of the DEG strategy? Specifically, we investigate how renewable energy innovation and energy transition mediate the impact of the DEG strategy on reducing carbon emissions. The DEG strategy facilitates renewable energy innovation by increasing the application of innovative knowledge, enhancing the flow and integration of innovative elements, and improving the efficiency of allocating innovative elements. Renewable energy innovation also reduces the cost of using renewable energy and enhances energy utilization efficiency, which is crucial in promoting industrial upgrading and reducing carbon emissions. Additionally, integrating distributed energy systems with local energy markets enables these markets to adapt more effectively to varying energy demands and supplies, improving the operational efficiency of the energy

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system. Within this framework, the energy transition from traditional to renewable sources provides a sustainable pathway for decarbonization.

This study makes three contributions to the existing literature. First, our study supports previous findings regarding the impact of China's DEG strategy on carbon emissions, thereby enriching the theory of environmental federalism. Second, we find that the specific channels of impact of the DEG strategy on carbon emissions are renewable energy innovation and energy transition. Third, we outline specific policy recommendations based on our empirical findings, emphasizing regional heterogeneity and encouraging technological innovation and the transition to new energy.

2. A short account of the research performed

We select China as the study context for the following reasons. First, China, as a major energy consumer, has an urgent need for energy transformation. Second, China is a significant global force in the development of renewable energy and has considerable potential to expand its application of renewable energy. In 2014, the China National Energy Administration implemented the New Energy Demonstration City (NEDC) policy, which added a distributed energy resource system to the Plan's assessment indicators, marking the beginning of the pilot policy for DEG. The NEDC policy provides a suitable quasi-natural experiment framework for this study. This study utilizes panel data from 283 cities and a Difference-in-Differences (DID) model to comprehensively and systematically analyses the direct effect and mechanism of impact of DEG on carbon emissions.

The results of this study suggest that the DEG strategy significantly reduces carbon emissions, primarily through innovations in renewable energy and energy transitions. Heterogeneity analysis further highlights that the policy's effectiveness is more pronounced in non-resource-based cities, R&D-intensive cities, and those with strong environmental regulations. These findings underline the importance of expanding DEG strategies and investing in resources to foster innovation and accelerate energy transitions, providing valuable policy recommendations for achieving carbon neutrality.

3. Main conclusions and policy implications of the work

The study draws the following three conclusions. First, our study supports previous findings that DEG is crucial in reducing urban carbon emissions. This study suggests that after the implementation of the pilot policy, the carbon emissions of pilot cities decreased by an average of 17.9%. Second, the mediating roles of technological innovation in renewable energy and energy transition are suggested as the channels through which DEG affects carbon emissions. Third, our study indicates that DEG has a stronger effect in non-resource-based cities, R&D-intensive cities, and cities with stronger environmental regulations than in their respective counterparts.

Building on these findings, we propose several policy recommendations. First, we suggest that the central government should further delegate energy governance authority to local governments. Second, we recommend that the government alleviate the R&D burdens on enterprises through targeted measures such as innovation subsidies and tax incentives. Third, the government should actively facilitate the transition to renewable energy by incentivizing new energy consumption, providing financial support, and strengthening renewable energy infrastructure to expand installed capacity. Fourth, it is essential to develop customized policies tailored to local conditions.