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# Competition Pattern and Regional Transfer of the New Energy Industry in the Global Context: A Comparative Study Based on Hebei and Fujian

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**ABSTRACT**
Against the backdrop of the gradual advancement of global carbon neutrality goals and the simultaneous deepening and encountering counter-currents of globalization, this paper takes representative enterprises from Hebei and Fujian provinces as case studies. It constructs an "industrial layout - factor coupling - enterprise strategy" analytical framework, combining New Economic Geography and Global Value Chain theories, to comparatively analyze the differential shaping mechanisms of non-market factors on industrial transfer paths. The research indicates that the global new energy industry transfer has shifted from cost-driven to technology-, market-, and green regulation-driven. Constrained by low-end capacity lock-in and the transmission of global trade risks, Hebei Province is forced to cope with crises through capacity relocation to Southeast Asia and equity restructuring. In contrast, Fujian Province, leveraging its port and technological innovation advantages, proactively engages in localized layout towards Europe. The divergent paths of the two provinces highlight the complexity of the interaction between regional endowment and globalization pressure, providing policy insights for optimizing the spatial governance of China's new energy industry.

**KEYWORDS**
New energy industry; Industrial transfer; Regional competition; Globalization

## 1 Introduction

### 1.1 Problem Statement

While the wave of globalization promotes the diffusion of new energy technologies, it also fosters counter-currents such as trade barriers and technological blockades. As the world's largest producer of new energy products, China's domestic industry is undergoing a complex process of "two-way transfer": on one hand, labor-intensive segments are relocating to resource-rich central and western regions; on the other hand, high-tech capacity is transferring to Southeast Asia and Europe to circumvent sanctions from Europe and the United States. This phenomenon cannot be fully explained by market factors alone; it requires incorporating analytical dimensions such as policy intervention and globalization as non-market factors.

The comparison between Hebei and Fujian provinces is of typical significance. As a core area under the Beijing-Tianjin-Hebei Coordinated Development Strategy, Hebei Province, relying on mineral resources and policy subsidies, has undertaken large-scale photovoltaic manufacturing capacity. However, due to EU and US "anti-dumping and countervailing" sanctions and overcapacity, it has fallen into passive adjustment. Fujian Province's new energy industry primarily focuses on the application end, such as new energy vehicles and power batteries, and excels in distributed energy applications. Through technological innovation and port advantages, it has achieved proactive global layout for its power battery industry. Analyzing the differentiated paths of these two provinces can not only enrich analytical frameworks like industrial transfer theory but also provide a theoretical basis for building a resilient structure for China's new energy industry.

### 1.2 Literature Review and Theoretical Framework

Nations are inevitably involved in the tide of globalization, and the new energy industry chain is unavoidably affected by domestic and international situations. Theories such as industrial transfer and location choice play important roles in explaining international factor flows, regional division of labor and agglomeration, and analyzing industrial patterns and development. Existing literature on the new energy industry under globalization can be broadly categorized into three types.

The first category discusses the development status and competitive landscape of the global new energy industry: Fang Xingdong and Du Lei (2019) studied the transfer of industrial competitive advantages brought by technological competition under globalization; Shang Liping (2020) analyzed the development situation of the global photovoltaic industry and made predictions based on data from organizations like the IEA.

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The second category researches the status of industrial transfer in China: Yang Xiaokai (2002) proposed the endogenous comparative advantage model and inframarginal analysis method, with the New Classical Economics school he represents questioning the theory of comparative advantage; Lin Yifu (2015) argued that the "Belt and Road" initiative should focus on industrial upgrading, suggesting the transfer of labor-intensive industries, further elaborating on factor endowment and technological comparative advantage (2004); Guan Aiping (2018) used a dynamic panel GMM model to analyze the impact of taxation and agglomeration effects on industrial transfer, discovering the interactive influence of economic agglomeration and tax competition on industrial transfer; Yuan Zhigang (2024) summarized and reflected on China's industrial transfer and upgrading over the past 20 years.

The third category concerns research on China's new energy industry. Domestic scholars have produced numerous macro and meso-level research results analyzing causes and influencing factors, as well as meso-micro studies based on specific enterprises or regions, and explorations of forward-looking pathways and policies. Scholars such as Niu Xuejie (2014) and Li Zhiguo (2015) have conducted factor analysis and discussion on financial support and the government's role in new energy industry development; Yang Fenghua (2014), Wang Keyi and Lu Zihan (2025) explored how to achieve high-quality development of new energy using coastal Jiangsu and Hebei region as examples, respectively; Zhang Jinliang (2024), Chen Xingxing and Tian Yixuan (2024) outlined and discussed the current situation and future of China's energy industry from a global perspective.

From the existing literature, these studies have formed a relatively systematic theoretical system, demonstrating the rich development of industrial and location theories from a global perspective and sustained attention to the new energy industry. Overall, research providing macro-level overviews industry trends and industrial transfer patterns, as well as micro-level studies on enterprise or regional countermeasures, is relatively abundant. Industrial transfer and its sub-theories have been relatively systematically and thoroughly researched. However, research linking these to the international and domestic competitive landscape of the new energy industry is insufficient, often focusing on summarizing industry information and data, lacking corresponding analysis and horizontal comparison with specific government or enterprise strategies, and largely neglecting the connection between the macro context and specific regions or enterprises. Research on new energy tends to focus on quantitative studies and model analysis related to the low-carbon economy and green development. Analysis of influencing factors on the new energy industry concentrates on financial policies like taxation, often analyzing a single region. There are few comprehensive studies linking globalization to the new energy industry landscape and regional transfer, and comparative studies based on different regions are rare, indicating certain limitations. This study hopes to compare the similarities and differences in the locational conditions of two provinces belonging to different economic circles/city clusters, use case study methods to construct an analytical framework, discuss the impact of globalization on new energy layout, clarify the competitive landscape and challenges of industrial development, and attempt to propose certain countermeasures to fill the research gap in related fields. Although industrial theory and new energy have developed for a considerable time, with a vast body of research, the highly dynamic and complex international situation means the development of the energy industry remains a long-term task. Currently, European and American policies towards China's new energy vehicles and upstream/downstream industries are sometimes changeable , but overall adopt a strategy of high tariffs, high standards, and high restrictions. Many small and medium-sized enterprises have been affected. Coupled with the strategic importance of new energy, market competition will only intensify, and industrial development faces many problems. How to cope with the negative impacts of globalization, how to achieve carbon neutrality, green development, and industrial upgrading remain issues requiring continuous attention.

This paper proposes a three-dimensional framework of "industrial layout - factor coupling - enterprise strategy" to address the aforementioned shortcomings. This framework treats globalization pressure as an exogenous shock, transmitted to the regional level through non-market channels such as policy environment, technological barriers, and trade rules, where it couples with local factor endowments, ultimately driving enterprises to adjust their capacity layout strategies. Factor coupling is the core mechanism, involving the interaction of natural resources, industrial base, innovation capability, and institutional environment. This framework differs from the unidirectional causal chain of traditional theories, providing a new perspective for explaining regional differentiated responses.

## 2 Case Analysis of Hebei and Fujian

Jingko Solar, headquartered in Xingtai, Hebei Province, is a leading photovoltaic module manufacturer with production bases across China. Amid fierce competition in the global PV market, it has continuously expanded its scale overseas, including in Southeast Asia. However, its degree of core technology independence still lags behind international first-tier enterprises, especially in the layout of cutting-edge technologies like perovskite tandem cells, lacking original innovation capability. It faces significant difficulties in corporate transformation and long-term development, bearing a heavy financial burden. In contrast, Fujian Province has built a globally competitive power battery industry cluster

centered on CATL. As of 2023, CATL held a 36.8% share of the global power battery installation market and achieved continuous breakthroughs in key technology areas such as sodium-ion batteries and condensed matter batteries. It not only invests heavily in R&D annually but has also established a sound talent cultivation system through cooperation with universities like Xiamen University. From a policy-driven perspective, the positive incentive effect of environmental regulation on renewable energy development has significant spatial spillover characteristics. Strengthening environmental supervision by local governments can effectively promote the growth of the new energy industry in both local and neighboring areas. Influenced by the Beijing-Tianjin-Hebei coordinated air pollution prevention and control policies, Hebei's initial development focus was concentrated on easily deployable technological paths like PV power generation, with policy tools primarily involving land concessions and grid connection support. Fujian, however, incorporated new energy into its eco-province construction strategic framework earlier, implementing more systematic industrial support policies, including special funds, innovation platform construction, and industrial chain investment attraction, forming a virtuous cycle of "government guidance - enterprise leadership - scientific research support." In terms of market mechanisms, Fujian, leveraging its proximity to the Taiwan Strait, actively expanded into overseas markets like Southeast Asia and Europe. CATL's proportion of overseas orders has increased year by year. Simultaneously, pilot reforms in the provincial electricity market advanced relatively quickly, and the distributed energy trading mechanism is relatively mature, providing enterprises with diversified profit models. In contrast, local market demand in Hebei is relatively singular, overly reliant on national subsidies and grid purchases, resulting in weaker risk resistance for enterprises when facing policy phase-outs. Regarding talent quality, Fujian, relying on high-level institutions like Xiamen University and Fuzhou University, has formed a stable talent supply in fields like electrochemistry and materials science, while also attracting a large number of high-level overseas talents. Hebei's higher education resources are relatively weak, and its attractiveness for high-end R&D positions is insufficient, constraining the possibility of technological leapfrogging. Geography determines energy structure and transportation costs. Fujian, with its many mountains and hills and limited land resources, finds it difficult to develop large-scale centralized PV power stations, thus turning towards high-value-added energy storage and power battery industries. Hebei, with its vast plains and industrial wasteland, is suitable for building large-scale PV bases but faces transmission channel bottlenecks.

Historically, the global new energy industry landscape exhibited characteristics of "core-periphery" restructuring. European and American countries strengthened their rule-making position through carbon border taxes and technological patent barriers, East Asia maintained its role as the manufacturing center relying on complete industrial chains, and Southeast Asia became a "buffer zone" for capacity transfer. Now, however, some developing countries, led by China, are focusing on the layout and innovation of high-tech industries, striving for rule-making power in the international market. Meanwhile, Europe is attracting more investment in industrial manufacturing, or rather, some European countries are actively planning the reshoring of basic manufacturing segments. This change stems from the continuous reshaping of political patterns and economic status under globalization.

Against this backdrop, China's new energy industry transfer presents a dual parallel trend: central and western regions, leveraging land and resource advantages, undertake upstream segments like PV module production. For example, the Xingtai PV industry cluster in Hebei attracts leading enterprises with low electricity prices. Coastal regions are accelerating the international layout of high-tech segments. Xiamen Port in Fujian, with its deep-water berths, has become a main hub for lithium battery exports to Europe. Some PV enterprises in Hebei relocated assembly segments to Vietnam to avoid tariffs but, due to a lack of core technology upgrade capability, fell into the "low-end processing" trap. Fujian enterprises, however, achieve technology standard output through patent licensing. For instance, CATL licensed its sodium-ion battery technology to Thailand's Charoen Pokphand Group, building a regional production network.

The new energy industry in Hebei Province has a long history and numerous enterprises. Cooperation between central state-owned enterprises, local SOEs, and private enterprises in the manufacturing and installation ends has been effective. As part of the Beijing-Tianjin-Hebei city cluster, it is affected by the coordinated air pollution prevention and control policy, facing strong emission reduction pressure, which prompts the government to increase the substitution of clean energy and guide investment and construction in the manufacturing end. The industrial transfer of Hebei's new energy industry exhibits characteristics driven by multiple factors including policy and market. Hebei possesses abundant wind and solar resources. Since 2016, the province has attracted PV enterprises like Jingko Solar to establish production bases in Zhangjiakou and Baoding and continuously expand installed capacity through its "New Energy+" plan offering land subsidies and tax reductions. However, this resource-dependent development model has structural flaws: on one hand, it is overly concentrated in low value-added segments like silicon materials and components, with R&D intensity long-term below the industry average; on the other hand, it has an excessively high and relatively singular dependence on European and American markets. In 2023, the EU's "Carbon Border Adjustment Mechanism" caused Hebei's PV exports to plummet by 23%. Furthermore, PV power generation technology has seen few breakthroughs, has low barriers to entry, and faces fierce market competition. Under pressure, Jingko Solar chose to transfer 30% of its capacity to Vietnam and introduced state-owned capital to alleviate its funding chain crisis. While this passive adjustment avoided trade risks

in the short term, it failed to break the low-end value chain lock-in. In recent years, Jingko Solar scaled down domestic production bases and built integrated capacity in countries like Vietnam, capturing the Southeast Asian installation market, and slowly weathered several years of time in the bottom of shock consolidation. However, its drastic reforms and investments also brought significant debt.

Over the past decade, Fujian Province has focused on developing downstream industries like new energy vehicles. Its development path demonstrates the guiding role of technological innovation capability. Relying on research platforms like Fuzhou University's Energy Materials Laboratory, the province has formed patent clusters in areas like lithium battery materials and battery management systems. The southeastern coastal areas of Fujian and Guangdong, benefiting from high economic vitality and grid absorption capacity, maintain deep communication with overseas markets. The government provides sufficient strategic emphasis on low-carbon transition and timely policy coordination, forming a competitive development model. CATL's R&D investment reached 17.8 billion yuan in 2023. Its self-developed third-generation CTP technology leads international peers by over 15% in battery volume utilization. This technological advantage translates into market discourse power: the enterprise not only established an overseas production base in Thuringia, Germany, but also dominates power battery standard setting in Southeast Asia through technology licensing. However, Fujian also faces challenges. Its complex mountainous terrain limits the construction of large-scale wind power bases, forcing enterprises to rely on imported lithium resources. The 2024 Indonesian nickel ore export ban caused a 12% increase in cathode material costs, indicating that international environmental fluctuations constrain its development.

## 3 Conclusion and Policy Recommendations

Industrial transfer, as a core mechanism of global economic development and regional structural restructuring, is undergoing constant evolution. The differences in the development paths of the new energy industry in Hebei and Fujian provinces, glimpsed through the rise and fall patterns of their representative enterprises, reflect the complex interaction of multiple factors such as technological progress, policy orientation, market dynamics, and environmental constraints. Currently, industrial transfer has evolved from the traditional relocation of labor-intensive manufacturing to a multi-dimensional systemic transformation driven by technological innovation, guided by green and low-carbon principles, and supported by digital enablement. It has shifted from targeting regions rich in cheap labor and resources to transfers aimed at seeking technological breakthroughs and market expansion.

First, from a macro perspective, the new round of industrial transfer exhibits "dual circulation" characteristics: on one hand, developed countries are reshoring some high value-added manufacturing segments through smart manufacturing and automation technologies to enhance supply chain resilience; on the other hand, developing countries still undertake a large amount of mid- and low-end manufacturing capacity, but the focus of transfer is shifting from solely cost advantages to comprehensive business environment, infrastructure support, and market demand potential. Simultaneously, with the acceleration of regional integration processes, the synergistic effects of industrial chains within Asia are strengthening, making countries like Vietnam and Indonesia important destinations for sectors like electronics information and textiles/apparel.

Second, technological innovation is reshaping industrial transfer paths. Digital technology, particularly the development of industrial internet platforms, is making production organization methods more flexible and networked. Enterprises can achieve cross-regional collaborative manufacturing through remote monitoring and data sharing, thereby weakening traditional location dependence. The energy internet platform, as an important window for resource development and allocation in the new era, has grown from serving single enterprises to covering entire industry chains, significantly improving resource allocation efficiency and industrial synergy capabilities.

Third, environmental regulation and the "dual carbon" goals are having a profound impact on industrial transfer. Strict environmental policies prompt polluting and energy-intensive industries to migrate from ecologically sensitive areas or regions with strict regulations to areas with greater environmental capacity and relatively lax enforcement, a phenomenon known as the "pollution haven effect." The implementation of national industrial transfer demonstration zones has, to some extent, altered the distribution pattern of regional environmental quality but also brought risks of cross-regional pollutant transfer. The industrial emission intensity of India and some Southeast Asian countries far exceeds that of China. The transnational transfer of the new energy industry presents both challenges and opportunities for these countries in controlling emissions. How to break the carbon lock-in effect is increasingly becoming an important factor in assessing the sustainability of industrial transfer.

Institutional factors and factor mobility are important elements affecting the efficiency of industrial transfer. Land price regulation directly influences enterprise investment location decisions. The minimum price policy for industrial land, while helping to curb excessively rapid land price increases, may inhibit the motivation for enterprises to climb to the high end of the global value chain. Simultaneously, the spatial matching degree of production factors like capital, labor, and technology also determines the actual effectiveness of industrial transfer. When factor mobility increases, industrial

transfer is more likely to occur and is more efficient. Today, the traditional linear industrial transfer model based on comparative advantage is being replaced by a network collaboration model based on innovation ecosystems, placing greater emphasis on system integration and value co-creation. Enterprises no longer make capacity layout decisions in isolation but rely on industrial clusters, innovation alliances, and digital platforms to build cross-regional, cross-industry collaborative networks. Therefore, future industrial transfer is not merely a physical spatial displacement but a holistic migration of institutional environment, innovation capability, and governance systems.

Based on the above findings, policy formulation needs to implement regionally differentiated governance. Hebei should promote the integrated application of PV and energy storage technologies, enhancing product added value by leveraging R&D resources from Beijing and Tianjin. Fujian needs to strengthen the overseas resource layout for key materials like lithium, cobalt, and nickel, while simultaneously expanding into emerging markets like the Middle East and Africa to reduce dependence on exports to Europe and America. At the national level, it is necessary to establish a monitoring platform for new energy industry transfer, dynamically assess the impact of global trade policy changes on regions, and provide institutional guarantees for enterprises' overseas layout through multilateral mechanisms like RCEP.

Industrial transfer in the new energy sector under globalization has transcended the traditional cost-driven logic, evolving into a complex game involving policy, technology, geopolitics, and other multidimensional factors. Hebei's predicament reflects the vulnerability of resource-dependent regions under the impact of globalization; its low-end capacity lock-in and passive relocation path highlight the deficiency in endogenous innovation capability. Fujian's success demonstrates that the synergistic effect of technological innovation and port hubs can hedge against the risks of trade protectionism, but resource constraints and market singularization remain potential threats. The evolution trend of industrial transfer is moving towards intelligentization, greening, regional coordination, and deep institutional integration. Facing this trend, regions should combine their own resource endowments and development stages, leverage the government's guiding role in industrial development and enterprise layout, formulate differentiated strategies for undertaking transfer, strengthen innovation-driven and green development orientation, improve factor market allocation mechanisms, and seize the initiative in the restructuring of global industrial chains.

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