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POLS 3482: East Asian Politics

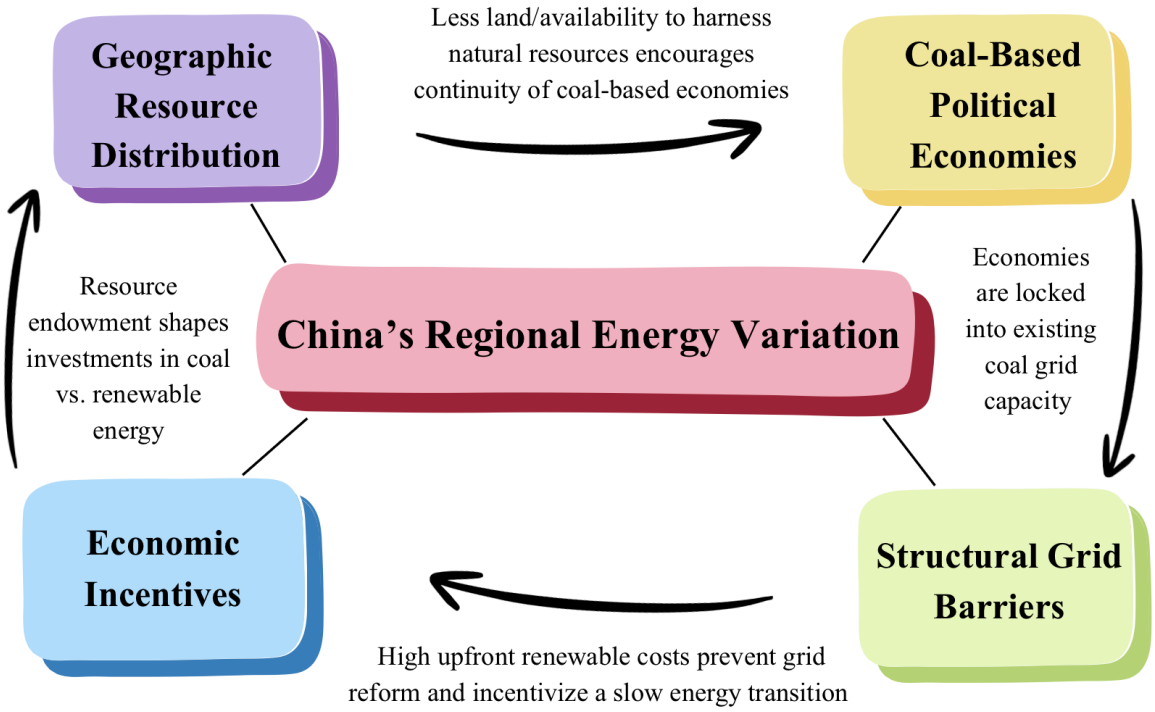
Roots of Coal, Winds of Change: Eastern China's Coal Dependency vs. Western China's Renewable Energy Infrastructure

Introduction

Standing in the wind corridors of Xinjiang, you hear the air's gentle hum and peer up at the endless fields of wind turbines stretching along the horizon, fueling the energy of China's Western region. Travel a few hours East to Shandong, and the landscape surrounding you transforms. A dark, foggy haze clouds the sky, making it difficult to see as your eyes begin to water. Each breath feels heavier as smoke seeps into your lungs. You hear children cough from behind the windows of their homes, kept out of school due to this smog-induced illness. Here, smokestacks replace windmills, and coal trains run day and night. Two provinces, one nation, one government. So what causes this stark juxtaposition? This paper seeks to address the question: Why is there variation in China's energy transition from fossil fuels to renewable energy across provinces, particularly between Western provinces of Xinjiang, Inner Mongolia, and Ningxia, and Eastern provinces of Shandong, Jiangsu, and Shanxi? China's Western provinces, particularly Xinjiang, Inner Mongolia, and Ningxia, are endowed with natural resources and have capitalized on them to emerge as leaders in renewable energy. Eastern provinces of Shandong, Jiangsu, and Shanxi have had a slower transition to renewable energy, with a strong reliance on coal. Regional differences across China's Western and Eastern provinces are best understood through an interest-based framework and are attributed to geographic resources, coal-based political economies, economic incentives, and structural grid barriers (see Figure 1). Correspondingly, this paper examines each of these mechanisms respectively to establish a comprehensive explanation of China's regional energy divergence.

Figure 1

Interconnected Drivers of Regional Energy Transition Variation in China



Note. Conceptual framework map developed based on Davidson (2024), Li et al. (2024), Huang et al. (2025), Lin et al. (2022), and Ma et al. (2025).

Methods

The theory of this paper is supported by peer-reviewed journals, the People's Republic of China Website, and Geographic Information System (GIS) data. Peer-reviewed journals were obtained from Scholar One and JSTOR, establishing the foundation through provincial-level quantitative data alongside qualitative policy insight and energy infrastructure observation. To provide contextual background, President Xi Jinping's 2025 Climate Address from the Ministry

of Foreign Affairs of the People's Republic of China website was analyzed to give insight regarding China's national climate goals. Further, GIS data was accessed through ArcGIS Online, sourcing data from a global GIS database for power plants and energy data. Together, these sources inform the comparative analysis conducted in this paper by providing an empirical foundation.

This paper employs a comparative case-study analysis, using qualitative and quantitative data, to examine the mechanisms that drive China's energy divergence between Eastern and Western regions. This explanatory method was selected because the research question seeks to understand the causal mechanisms of regional energy variation. By comparing provinces that operate under one national policy framework, regional factors are isolated to effectively explain divergent energy patterns across China. The three Western provinces of Xinjiang, Inner Mongolia, and Ningxia were selected because they are among China's leading provinces for renewable energy production, best illustrating the Western renewable energy advantage (Li et al., 2024). Similarly, the Eastern provinces of Shandong, Jiangsu, and Shanxi were selected because their economies rely on coal, which illustrates the barriers to energy transition in the East (Davidson, 2024). Together, these six regions offer valuable insight into the unique advantages and challenges of China's Western and Eastern regions.

To further support the provincial comparative analysis, four types of data visualization were employed: a conceptual map, a text heuristic, charts, and a GIS map. The conceptual map was developed using Canva and informed by the research of Davidson (2024), Huang et al. (2025), Li et al. (2024), Lin et al. (2022), and Ma et al. (2025). The visualization of regional energy divergence mechanisms seeks to show their connection to one another and outline the format of this paper. Building on this framework, the text heuristic was developed using Voyant,

specifically the word cloud generator tool. In the text heuristic, Xi Jinping's 2025 Climate Address serves as the corpus to identify dominant speech terms and assess the alignment of national climate rhetoric and the reality of regional energy practices. To visualize the regional energy disparities quantitatively, charts were developed by inputting datasets from Davidson (2024), Li et al. (2023), Li et al. (2024), and Liang et al. (2019) into Google Sheets. Finally, the GIS map was produced using ArcGIS Online, layering power plant coordinate data from the Global Energy Monitor and Global Power Plants database over a base map sourced from Esri, TomTom, Garmin, and OpenStreetMap to illustrate the distribution of different types of energy infrastructure across China's provinces. Collectively, these analytical methods illuminate the regional energy disparities addressed within this paper.

Context

The transition from fossil fuels to renewable energy has not been seamless across China; rather, regional differences have evolved from geographical challenges. Figure 2, a text heuristic developed from China's President Xi Jinping's speech at the Leaders Meeting on Climate and the Just Transition, emphasizes the nation's role as an international climate leader.

Figure 2

Dominant Terms in Xi Jinping's 2025 Climate Address

Note. Word cloud generated from Xi Jinping's address at the Leaders Meeting on Climate and the Just Transition (Xi Jinping, 2025).

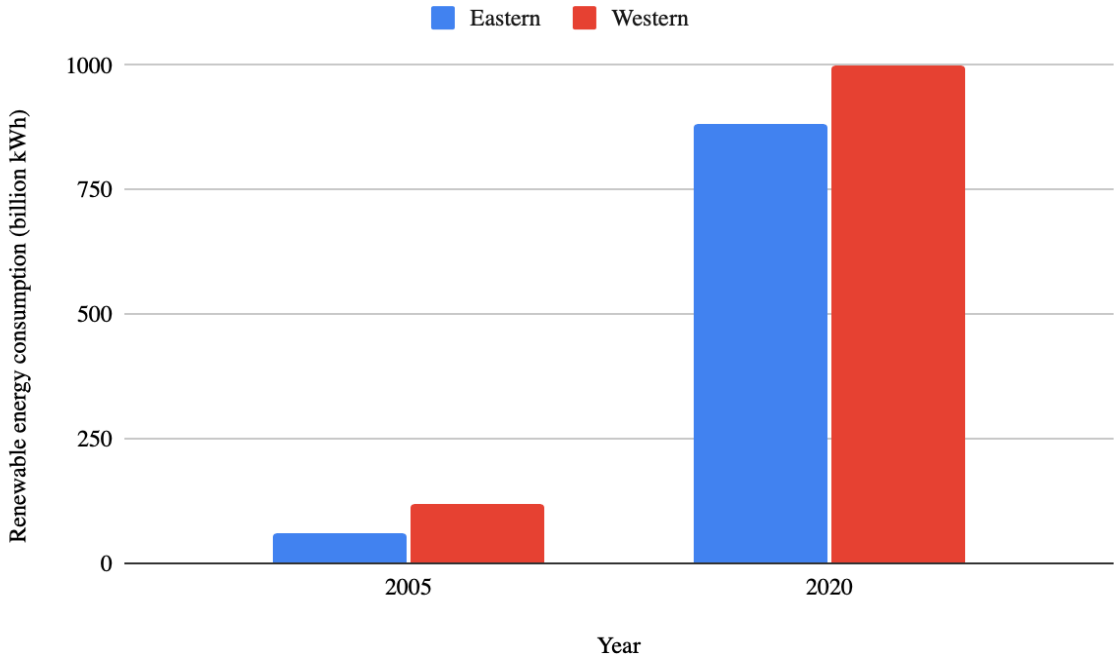
In President Xi's speech at the Leaders Meeting on Climate and the Just Transition, the words "international", "climate", "cooperation", "development", and "global" emerge as the most repetitive and prominent. This centers Xi's perspective of China's dominant position on the international stage to reflect a national sustainability focus. Further, this rhetoric highlights China's ambitious goals as an international climate leader, to invest in sustainable development, and initiate global cooperation.

Despite Xi's pro-climate portrayal of China as a centralized entity, regional stagnancy with fossil-fuel-based energy persists. In terms of policy, "The Renewable Energy Law of the

People's Republic of China was adopted in 2005 and came into force on January 1, 2006. To a large extent, it has contributed to the strong development of the renewable energy industry" (Li et al., 2024). Though this unified national renewable energy law was enacted, inconsistent implementation followed. China's climate action is multifaceted, contradicting assumptions of uniform action or a seamless top-down environmental approach (Li & Shapiro, 2022). The intricate implementation structure demonstrates a decentralized approach to clean energy despite national clean energy goals. This regional energy variation prioritizes China's economic focus over its climate mitigation commitment.

Figure 3

Regional Renewable Energy Consumption in China



Note. Renewable energy consumption (in billion kWh) across Eastern and Western regions of China in 2005 and 2020. Data sourced from Li et al. (2024).

Both Eastern and Western regions of China significantly increased renewable energy production from 2005 to 2020 (see Figure 3). However, the gap between the Eastern and Western production of renewables widened as well, presenting energy divergence between these two regions. In this divergence of the East and West, it is essential to first evaluate the role of interests, ideas, and institutions to understand the framework that drives variation in renewable energy transition.

Interests, Ideas, and Institutions

The regional disparities in China's energy transition are best understood through an interest-based framework. China's Southwest region is abundant in water, making hydropower a crucial part of rural renewable energy development in the region (Li et al., 2023). The economic investment in renewable energy for regions with abundant natural resources, particularly in China's Western provinces, appeals to the interest-based framework. An idea-based framework would suggest universal renewable energy implementation across China. This, however, is not the case, and the cost-efficiency of implementing renewable energy as the main source of energy in the West differs from the East's continuity with coal consumption. Similarly, if institutions drove this energy transition, uniform policy implementation would be prevalent. Despite national energy legislation, such as the Renewable Energy Law of 2005, uneven outcomes in energy infrastructure exist across China's provinces. Rather, this energy transition is driven by the material interests of the geographic natural resource endowment.

Material interests are not only invested in the natural resources of the West but also in the coal-centered East as well. In the East, coal has "built up whole local economies and generated organized interests around coal extraction and consumption industries" (Davidson, 2024). The Chinese political economy thrives on coal production and demonstrates the material interest to

advance the economy by simultaneously producing and consuming both coal-based and renewable energy. China invests in the financial incentives of coal rather than the idea-based continuity of coal because there is no consistent investment or divestiture from it. National climate rhetoric (Xi Jinping, 2025) identifies ambitious, uniform clean energy goals, which undermines the implementation gap in the Eastern region. Therefore, the national idea-based framework prioritizes renewable energy investment, but failure to implement it uniformly illustrates that the variation cannot be attributed to ideas. If institutions were the primary driver, wealthy Eastern provinces, such as Jiangsu and Zhejiang (Huang et al., 2025), would be at the forefront of the renewable energy transition. However, the coal-based economies of the East prevent institutions from changing their energy landscape because they depend on coal to meet their energy needs. Though institutions enact policies to advance China's climate-oriented role on the international stage, they are only partially effective because material interests in coal-based energy take precedence over policy.

The Eastern provinces are already abundant in coal; therefore, it would cost more to invest in renewable resources than in the West. Fossil fuels are relatively cheaper than renewable energy in China (Li et al., 2024). These energy choices are deliberately based on cost-efficiency. Decisions are informed by which resources are most accessible and advantageous for a region to produce the most energy at the lowest cost. This is driven by economic efficiency, demonstrating interests rather than ideological commitment to certain energy types or institutional preferences for coal. Despite national decarbonization efforts, the "build first, retire later" (Davidson, 2024) approach to coal consumption illustrates material interests prioritized over the climate goals of institutions.

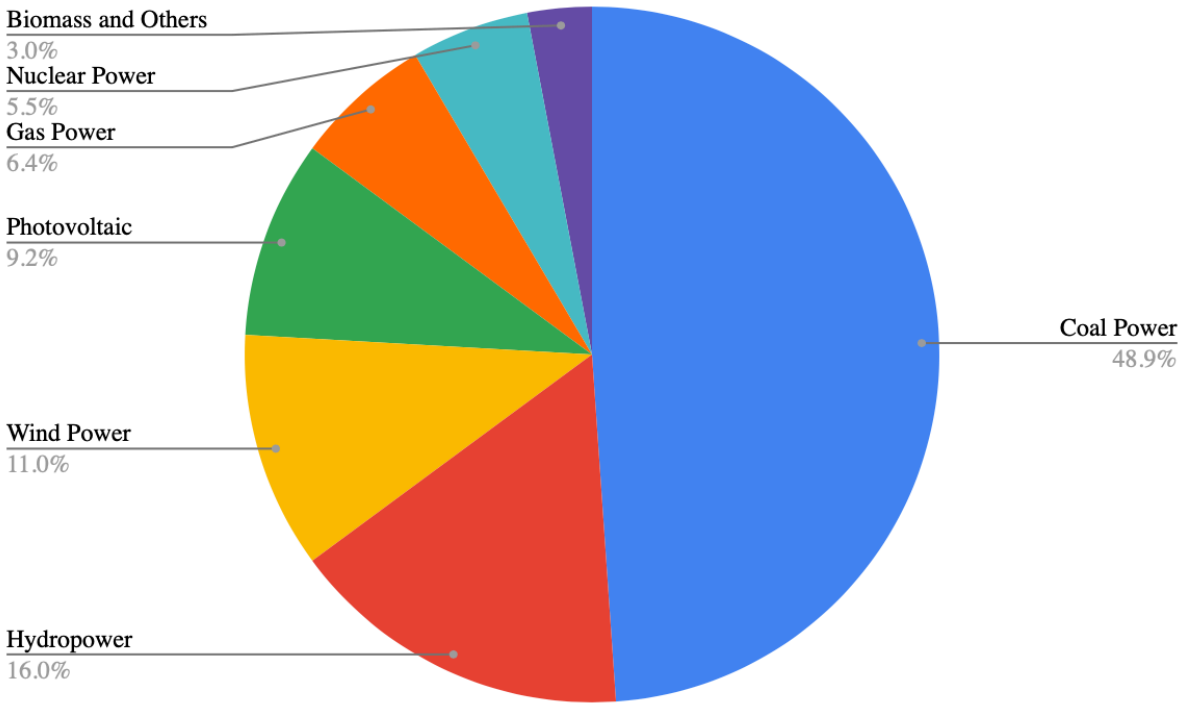
Beyond resource endowments and economic efficiency, coal infrastructure acts as a structural barrier, bolstering the material interests that prevent a seamless transition to renewable energy. China's surplus of coal power plants limits grid flexibility and renewable integration (Lin et al., 2022). Existing coal infrastructure occupies grid capacity needed for a broader transition to clean energy. This infrastructure barrier further incentivizes coal reliance because the grid infrastructure is centered around coal, making it economically advantageous. This is best understood through an interest-based framework because maintaining coal power plants enhances China's economic state. This barrier is not ideational because there is a national commitment to clean energy, but there have not been efforts to dismantle coal grid infrastructure. The ideas fail to translate into actionable results, furthering this regional divide. Likewise, it is not institutional because while renewable energy policy exists, provinces maintain ties to the coal-based energy grid. The material interests of coal are embedded in China's grid capacity despite institutions advocating for renewable energy. The regional energy disparities across China are an interest-based issue since decisions are made on a regional basis according to what will best benefit China's economic interests.

Geographic Resource Distribution

Natural resource endowment both creates an opportunity to harness renewable energy in geographically abundant regions of the West and constrains the opportunity for Eastern provinces. Figure 4 illustrates China's projected electricity composition for 2025, outlining what the vision was for different types of renewable and non-renewable energy usage.

Figure 4

China's Projected Electricity Generation Composition, 2025



Note. Projected electricity generation by energy type in China for 2025, illustrating coal power's continued dominance at nearly 49% of total generation. Data sourced from Li et al. (2023).

Though Figure 4 illuminates the ambitious renewable energy goals in this projection, the prediction for coal-based energy takes up nearly half of the projection, demonstrating a strong reliance. This picture of coal versus renewable energy is not uniform across China. Dissecting this divergence of renewables, “The western region has vast and diverse renewable energy resources, including solar, wind, hydropower, and geothermal. For the resource endowment conditions in the western region, the mountainous terrain of the region provides ample opportunities for hydropower generation” (Li et al., 2024). The Western abundance of natural resources creates regional opportunities to drive the transition to renewable energy.

Figure 5

China's Power Plant Distribution by Energy Type

Note. Power plant locations by energy type across China. Wind (green) and hydro (light blue) are concentrated in central and western provinces, while coal (orange) and gas (pink) cluster densely in the eastern coastal region. Map developed using GIS data.

As Figure 5 illustrates, the geographical conditions of the mountains make hydropower implementation easier than in areas with flat terrain and less access to water sources. Similarly, western regions of Xinjiang and Qinghai have the infrastructure to harness solar and wind energy (Li et al., 2023). The water, solar, and wind advantages of the West drive the renewable energy transition and incentivize capitalization of resources for economic efficiency. However, it is

important to note that some Western regions are an exception to this trend. Guyuan and Shizuishan's scarce wind and solar resources make it difficult to implement certain renewable energy projects (Ma et al., 2025). The geographic barriers in some Western provinces, such as Guyuan and Shizuishan, demonstrate that though the Western region of China has abundant pockets of natural resources, it does not necessarily encompass the entire region.

The natural resource capacity in the East paints a different picture than that in the West. Land in the Eastern region is more populous, creating less land space for renewable energy projects (Huang et al., 2025). The geographic capacity is constrained in the East. That is not to say it is impossible to implement clean energy alternatives, but the Western region has a stronger resource advantage with its land structure. In terms of renewable energy development, “The central and Eastern provinces should be committed to researching biomass utilization technologies to exploit the emission reduction potential of biomass resources” (Li et al., 2023). Given the East's natural resource endowment and land capacity, research into biomass energy would allow the East to produce energy alternatives to fossil fuels and catch up to the West in this energy transition. The uneven geographic resource distribution and land capacity establish the material foundation for energy variation. However, to understand the Eastern region’s resistance to energy transition, a deeper look at their coal-based political economies is essential.

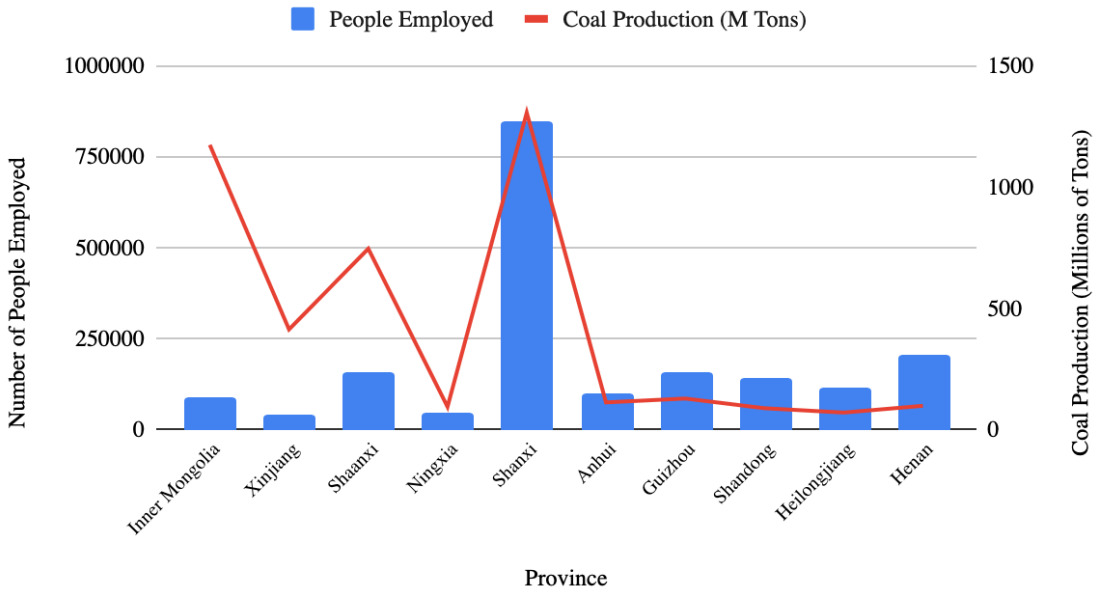
Coal-Based Political Economies

A broad, sustained tie to coal, particularly with Eastern industrial dependency and fiscal reliance, contributes to regional energy transition disparities. Coal represents the political economy issue of actors’ material interests in capitalizing on energy through its continued use. The Eastern region’s economic growth has had a historical energy supply rooted in coal to fuel manufacturing, construction, and transportation in its industry-driven region (Li et al., 2024).

The Eastern region's focus on industrial growth, coinciding with demand for coal, stimulates economic growth at the cost of increased carbon emissions. The high demand for energy in Eastern China, culminating in historical reliance on coal, has caused the shift to a slower renewable energy transition compared to the West. The Northeast coastal region's industry-driven activities are the region's most significant carbon emissions contributor, and increased emissions by 230 million tonnes in 2020 (Huang et al., 2025). The fossil-fuel embedded Northeast coast of China is intertwined with its industrial-driven economy. The material interests of expanding industry for economic growth while retaining coal-based energy, due to its regional abundance, are problematic for the environment, yet they incentivize the use of fossil fuels.

Figure 6

2022 Provincial Coal Employment and Production



Note. Coal employment (number of people employed) and coal production (millions of tons) across select Chinese provinces in 2022. Data sourced from Davidson (2024).

Examining Figure 6, Shanxi, a province within the Eastern region of China, stands out with its high employment in the coal-related sector alongside high coal production. This illustrates how coal production and employment in the industry are prevalent in the Eastern province of Shanxi. Looking at other Eastern regions, such as Shandong, Anhui, Henan, and Heilongjiang, production and employment related to coal are not as high, but there is still a correlation between them. In contrast, this correlational pattern ceases to exist to the same extent in the Western provinces, specifically Inner Mongolia, Xinjiang, and Ningxia. It reinforces the notion that the Eastern provinces have a stronger reliance on the coal industry. This further attributes regional variation to interest-based ties through the Eastern region's coal output and jobs provided by the coal industry.

Coal not only stimulates economic growth and provides jobs, but the existing infrastructure also provides a safety net for meeting energy demand in the East. For instance, "Power shortages in 2021 and 2022 re-elevated energy security objectives in the context of coal supply... referring to the need to 'build first, retire later'" (Davidson, 2024). The increasing energy demand furthers the reliance on coal. Sustained use of coal allows the Eastern provinces to maintain energy stability but prioritizes short-term energy demands over long-term environmental consequences. Beyond the industrial dependence and job opportunities of the coal industry in the East, the cost of fossil fuels versus renewable energy reinforces the regional divide.

Economic Incentives

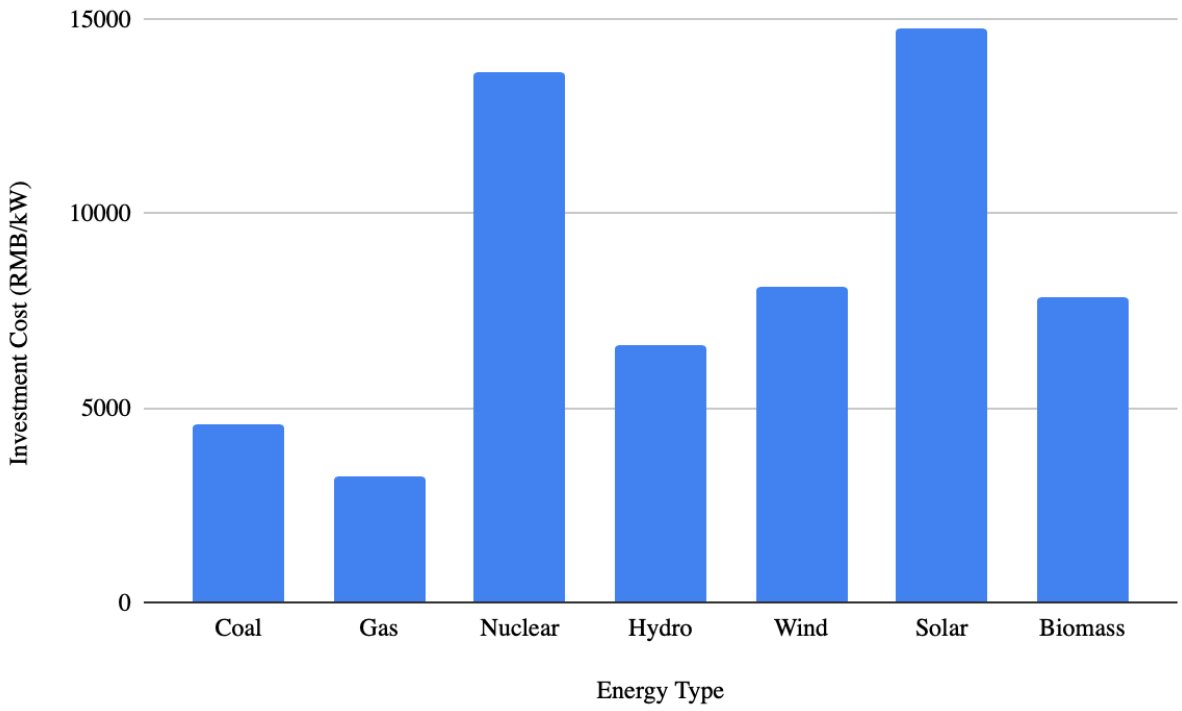
Economic investment in structural changes to clean energy adoption or enhanced fossil fuel interdependence shapes regional differences in energy transition across China. China's wealthier Eastern provinces, Shanghai, Jiangsu, and Zhejiang, are technologically advanced and

operate at lower energy intensity, creating a favorable position for renewable energy transition (Huang et al., 2025). However, the industry-driven wealth of these Eastern provinces is fueled by a coal-based economy; despite this favorable position, these provinces are behind Western provinces in the energy transition because of interests in the financial incentives of the coal-driven industry. By contrast, in the Western province of Ningxia, population growth influenced renewable energy development to meet increased energy demand, and per capita GDP grew as a result of renewable energy capacity (Ma et al., 2025), demonstrating that wealth is not a prerequisite for energy transition, but interest alignment is.

The contrast between Eastern and Western energy investment structures illustrates that economic interests drive regional actions. Industry restructuring and energy intensity are decisive factors in curbing China's carbon emissions (Huang et al., 2025). Breaking away from the coal-reliant economic state would enable the industry-driven East to meet demand while supporting the nation's sustainability goals. Cities in Ningxia, like Zhongwei and Wuzhong, achieved urbanization growth of 7.5% and per capita GDP growth of 35.9% and 44.9% by 2021 (Ma et al., 2025). Ningxia serves as a model that economic development and renewable energy development do not have to be separate goals. Economic growth can be invested directly into renewable energy, which in turn serves the economy, establishing a circular effect. Conversely, Eastern provinces like Shanghai, Jiangsu, and Zhejiang remain structurally capable of renewable energy but constrained by financial interests (Huang et al., 2025). Ningxia demonstrates it is possible to break free from the cycle of focusing solely on economic interests, which are what have caused the regional differences to begin with.

Figure 7

China's Upfront Investment Costs by Energy Type



Note. Upfront investment costs (RMB/kW) by energy type in China. Data sourced from Liang et al. (2019).

Figure 7 draws attention to the high upfront costs of clean energy, particularly nuclear and solar. Since China is focused on producing large quantities of energy at a lower cost, regions that are geographically suitable to harness these types of energy have departed from coal-based infrastructure. However, since coal is relatively inexpensive, Eastern provinces are fairly locked into this type of energy infrastructure. Western provinces abundant in solar and wind resources choose to confront the higher upfront costs because they are offset by long-run operational advantages. Further reasoning why certain regions, like Ningxia, choose to develop their economy and energy infrastructure simultaneously. Despite economic incentives favoring

renewable energy investment in the long-term, the Eastern provinces remain dependent on coal through the physical infrastructure of the energy grid.

Structural Grid Barriers

Infrastructure deficits and structural barriers deepen regional disparities and establish a spatial mismatch of renewable energy production and consumption. The Eastern provinces have the advantages of advanced economies, stronger energy systems, and high rural incomes, whereas the western provinces lack this infrastructure complexity (Wang et al., 2025). Though the western regions have had a more seamless transition to renewable energy, the fossil-fuel-based Eastern economies are more developed, deepening the regional divide. Since the Eastern economies are more developed, their interests remain in keeping their economies strong, and transitioning to renewables might cause fears of threatening their success.

The industry-driven Eastern region has greater energy demand than the West, creating a spatial mismatch. In this case, “Regions with high renewable energy generation in China do not align with regions with high electricity consumption. Non-hydro renewable energy production is mainly concentrated in the Northwest, while consumption is primarily in the southeast” (Ma et al., 2025). Although the Northwest region produces more renewable energy, they still consume fossil-fuel based energy. This demonstrates that regional choices to remain coal-dependent affect the entire energy grid, suggesting the need for redeveloped grid infrastructure and a more unified energy transition approach. Beyond grid infrastructure, centralized energy policies across China are essential to address the regional disconnect and initiate a more cohesive approach to energy sustainability. Renewable energy will become cheaper over time, attracting economic investment in clean-energy infrastructure and creating opportunities for jobs (Lin et al., 2022). Once the

upfront costs of renewable energy become cheaper, the Eastern regions will likely transition to energy more efficiently. In this approach, economic incentives will also benefit these regions' local economies and reinforce the value of broader renewable energy enforcement across all of China's provinces, addressing the deep-rooted disparities.

Conclusion

Standing in smog-filled Shandong, gazing at the hazy sky once again, the crisis of these regional energy disparities is difficult to ignore. The deliberate choice to continue the use of coal in China's Eastern region for economic growth comes at the cost of health and livelihood. Children miss school because the polluted air is too dangerous to breathe, and elderly residents suffer from decades of exposure to industrial pollution. Together, this paints the picture of an energy development model where economic growth is worth more than human lives.

Climate change impacts every living, breathing human on this Earth. The energy choices that governments make across the globe have both domestic consequences for emissions and universal implications for the future of the planet. Enacting climate policy does not necessarily equate to implementation, which has repercussions. As a leading global power, China is responsible for being at the forefront of climate change solutions, yet its regional energy disparities reveal that economic interest is more of a national priority than human livelihood. China must move beyond regional interest-based approaches to energy and consider the broader implications on its environment, rather than using the blend of renewable and fossil-based production strictly for fiscal growth. This solution-oriented responsibility encompasses making energy choices for the interest of human livelihood and the Earth's future rather than choices that benefit economic standing.

China's regional energy divide serves as a lesson beyond its borders. When governments choose to prioritize short-term economic growth at the expense of long-term environmental and societal costs, communities suffer from the air they breathe. As the province of Ningxia demonstrates, economic growth and renewable energy development can occur simultaneously; nations do not have to choose one over the other. Rather, it is the responsibility of all nations to move beyond the sustainability rhetoric and take action by investing in renewable energy infrastructure to prioritize their citizens. This is not only an environmental issue but ultimately a moral imperative to address regional disparities through renewable energy transition. Communities bear the cost of developmental choices most, therefore, a sustainable future is only possible when decisions prioritize human livelihood.

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