Analysis of China's Investment Strategy: A case study of China's Clean Energy Transformation 2024 on energy security

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ABSTRACT

China currently stands as the world's largest energy consumer. China's energy consumption is accounting for approximately 25% of global energy demand, and is projected to increase annually. This study aims to examine China's strategic approach to achieving energy security through extensive investments in clean energy. In response to growing energy consumption and the imperative to ensure long-term sustainability, China has initiated a significant transition toward renewable energy sources as part of its national resilience strategy. Based on the theoretical framework of energy security, this research investigates the nexus between state-driven policy interventions and China's clean energy transformation. Employing a qualitative methodology, the study adopts a descriptive-analytical approach, drawing on case studies and data derived from official government sources, peer-reviewed journals, policy reports, and credible news outlets. The findings reveal a substantial reduction in fossil fuel reliance alongside a marked increase in non-fossil energy consumption between 2018 and 2024. iChina's strategic orientation toward clean energy transformation has directly contributed to the enhancement of non-fossil energy supply, thereby reinforcing its energy security agenda. Ultimately, this transition underscores China's pursuit of a self-sufficient and long-term energy security framework grounded in renewable energy development.

Keywords: *China, Energy Security, Clean Energy, Energy Transformation*

INTRODUCTION

Global energy demand continues to increase in line with population growth and economic development. Amid rising energy demand, the world is facing major challenges in the form of limited fossil fuel resources, dependence on imported energy, and the threat of climate change due to high carbon emissions. Global energy crises that have occurred in various periods have shown how vulnerable the world's energy system is to supply disruptions and price fluctuations. On the other hand, technological developments and declining renewable energy production costs have encouraged many countries to shift their focus to more sustainable clean energy sources.

As the country with the largest energy consumption in the world, China continues to face increasing challenges related to environmental pollution associated with its enormous energy consumption. China's energy consumption is estimated to be around 25% of the total worldwide. In addition, its coal consumption is around 50% and its CO2 emissions are around 30% of the world's total (Fu & Ng, 2020). In this context, China, as one of the world's largest energy consumers and producers, has begun to take the

initiative by increasing massive investment in the clean energy sector. This transformation is not only aimed at supporting global climate targets, but also forms part of the country's long-term strategy to build a more stable and independent energy system. China's move to promote energy transition by increasing investment in the clean energy sector is in line with growing domestic and global needs. As a country with rapid industrial growth and urbanization, the need for a stable and sustainable energy supply is increasing.(Prontera, 2024). However, on the other hand, high dependence on energy imports, especially oil and gas from geopolitically unstable regions, could raise concerns about potential supply disruptions in the future. To address this situation, the Chinese government has begun to prioritize the clean energy sector as the main foundation for building an energy system that is more independent and resilient to global shocks.(Mathews & Tan, 2015). Major investments in solar power plants, electric vehicles, and battery infrastructure are important indicators that this energy transformation is not solely driven by environmental issues, but also by strategic considerations in maintaining the stability and sustainability of the national energy supply (Wells, 2024).

This article will discuss how China's investment in renewable energy can be understood in the context of energy security. By reviewing China's clean energy policy direction and strategy, this paper will explore how the transformation towards sustainable energy is not only aimed at fulfilling environmental commitments, but also at reducing dependence on imported energy and strengthening the stability of domestic energy supplies. Through this approach, the article will examine the relationship between energy transition and national energy security, and analyze the role of clean energy as a strategic instrument in strengthening China's position amid global geopolitical dynamics.

METHODS

The research method used is qualitative, employing descriptive analysis. Descriptive analysis is used because the data consists mainly of numerical principles, laws, theories, and social phenomena or conditions. Qualitative research uses an approach to explore and understand the meaning of a problem that arises in society or humans. The process that occurs in qualitative research involves questions in the procedures that will arise, and the data used in the research is made inductively from specific to general matters, and the researcher makes interpretations in the form of existing data, and the final result is a flexible structure (Creswell & Creswell, 2018).

This study uses a qualitative method with a descriptive-analytical approach. This method was chosen based on the research objective, which is to gain an in-depth understanding of the dynamics of clean energy transition in China within the framework of energy security. The research data was obtained through a literature study covering academic books, scientific journal articles, international agency reports, and official government publications discussing the development of clean energy and China's energy policy. The secondary data was analyzed using content analysis techniques, which examine the substance and meaning contained in various sources to find patterns, trends, and

strategic implications of China's energy policy. Data validity was strengthened through source triangulation by comparing information from various literature.

As an analytical framework, this study uses the theory of energy security, which emphasizes four main dimensions, namely availability, affordability, accessibility, and sustainability. This theory is used to assess the extent to which China's clean energy investments and innovations contribute to strengthening domestic energy security while enhancing the country's strategic position in global energy governance. With this framework, China's clean energy transition is understood not only as an effort to mitigate climate change, but also as a geopolitical instrument to secure future energy supplies based on renewable technologies.

RESULTS AND DISCUSSION

China's Clean Energy Investment Efforts

In 2024, China intensified its efforts to diversify its energy sources through aggressive expansion in the field of renewable energy, particularly solar, wind, electric vehicles, and energy storage technology. The country accounted for about two-thirds of the total global investment of US$2.1 trillion in energy transition, with a primary focus on developing electricity grids and battery infrastructure. Technically, China leads the world in building renewable energy capacity, operating more than 1.4 TW of solar and wind power by the end of the year and adding hundreds of gigawatts of new capacity in just one year. This strategy reduces the risk of dependence on fossil fuel imports and lessens sensitivity to geopolitical shocks in the global energy market, thereby strengthening domestic supply stability. Although investment grew more slowly than in the previous year, with growth of only about 7% due to oversupply and project intensity, it demonstrates the seriousness of long-term policies to control energy accessibility and sustainability (Ember, 2025). In addition, the push for domestic industries such as solar panel manufacturing, EV batteries, and charging station development supports the development of a clean national value chain, while reducing dependence on foreign technology. China's clean energy investments also reflect efforts to anticipate long-term challenges related to geopolitical volatility and global energy supply risks. By strengthening domestic capacity from upstream to downstream, from technology production to energy distribution, China is not only targeting emission reductions but also creating an energy system that is more resilient to external pressures. This is in line with the principle of energy security, which emphasizes the importance of control over strategic energy resources and technologies. In addition, increasing clean energy capacity also provides greater flexibility in China's foreign energy policy, due to its dependence on energy import routes.

Energy resources are a very important component in terms of production and living standards. Energy consumption has always been closely related to economic development since the beginning of the industrial revolution. Energy consumption has become a major factor in both economic development and energy consumption. Current energy consumption has experienced a relatively rapid upward trend worldwide. China, as a country experiencing rapid industrial growth, has begun to invest

heavily in its efforts to maintain energy security. China has invested approximately to build energy centers and solar panels for its long-term energy needs. According to (2018), China's investment in the clean energy sector has increased from year to year. This is influenced by China's continuing demographic growth, such as population growth, industrial sector growth, and increasingly advanced technological developments. As a result, the energy sector is a sector that continues to receive attention from the Chinese government.

The world still does not understand the scale of China's commitment to renewable energy. Not many people know that China has built a renewable energy system powered by water, wind, and solar that is larger than the renewable energy systems built by the United States, Germany, India, and Spain combined. While the scale of China's commitment to building coal-fired power plants is widely recognized and lamented, the fact that investment in fossil fuel capacity is nearing its peak and appears set to decline in the near future is less widely acknowledged (Wang, 2025). Even less appreciated are the reasons guiding China's massive commitment to renewable energy sources. China's massive commitment to renewable energy sources has more to do with cleaning up smog-polluted skies and waters, building new industries, building new industrial capacity, and improving energy security than with reducing carbon emissions (although the latter goal is important). Meanwhile, the global impact of China's commitment to renewable energy, in terms of lowering costs not only for itself but for everyone, remains underappreciated.

China's National Energy Administration (NEA) released its 2024 energy work plan on Friday, laying out a roadmap aimed at promoting a green and low-carbon transition in the country's energy sector while enhancing energy security. The NEA set a target of securing China's energy supply at around 4.98 billion tons of standard coal equivalent for 2024. The NEA also outlined strategies to maintain stable coal production growth, keep crude oil production above 200 million tons, and achieve rapid growth in natural gas production. The plan also estimates that total installed power generation capacity will reach about 3.17 billion kilowatts, with electricity production expected to reach about 9.96 trillion kilowatt-hours. Key to the NEA's strategy is optimizing China's energy structure, with the ambition of increasing the installed capacity of non-fossil fuel energy to about 55 percent of total capacity (Global Times, 2024). Wind and solar power are projected to contribute more than 17 percent to the national electricity supply, and natural gas will reach about 18.9 percent of the total energy consumption mix. The NEA also aims to change energy consumption patterns in line with clean and low-carbon development trends, intensify the substitution of clean and low-carbon energy, and promote energy conservation, pollution reduction, and carbon reduction in the energy sector. In addition, the strategy also encourages the promotion of environmentally friendly and low-carbon lifestyles and production modes, as well as advancing energy technology innovation.

Last month, China installed an 18 MW offshore wind turbine, which is the largest wind turbine in the world, further contributing to its clean energy transition. Other countries have also taken note of this effort, including Germany, which will install Chinese-made

wind turbines in its offshore wind farms. In addition to wind power, China has fully embraced solar power as an alternative clean energy source. In June, the country activated a 3.5-gigawatt solar power plant covering 33,000 hectares outside Urumqi, the capital of Xinjiang - the largest in the world. Not to be outdone, China announced plans to build a giant 8 MW solar power plant as part of an $11 billion integrated energy project led by state-owned power company China Three Gorges Renewables Group. According to a report from Climate Energy Finance (CEF) on July 2, 2024, China is on track to reach its target of 1,200 GW of wind and solar installations this month. The original schedule for achieving this green energy target was 2030, so China has reached this target six years ahead of schedule and shows no signs of slowing down (Bathgate, 2025).

China installed 103.5 GW of clean energy capacity in the first five months of 2024, while its thermal energy additions declined 45% year-on-year. This indicates a transition away from coal and nuclear power toward cleaner alternatives while still meeting growing demand on its local power grid. Although China is rapidly becoming a global leader in clean energy adoption, it still has some work to do. The country remains heavily dependent on coal-fired power plants and needs to phase out these facilities in favor of more sustainable options to truly offset its CO2 emissions. While many developed countries need 40 to 70 years to transition from peak emissions to carbon neutrality, China aims to achieve this in 30 years—reaching its peak before 2030 and hitting net zero before 2060. China must reach net zero while maintaining energy security for 1.4 billion people and transforming energy demand from the world's largest industrial base. China must continue urbanization, achieve modernization targets by 2035, reduce coal use, and meet growing energy needs as living standards rise. China has made the global green transition more cost-effective (Qin, 2025). However, China's affordable clean technologies are sometimes viewed as a problem of "overcapacity." China's rapid growth in green transition industries such as solar panels, wind turbines, and electric vehicle manufacturing gives global consumers access to affordable green technologies. However, the lower prices of these products compared to those made in the United States or the European Union, for example, have triggered investigations, higher tariffs, and market access restrictions in response to perceived trade imbalances.

Energy Security Analysis

An analysis of China's clean energy transition can be understood through the energy security theoretical framework proposed by Daniel Yergin. Yergin (1988) emphasizes that energy security encompasses four main dimensions, namely *availability* (supply availability), *accessibility* (ease of access to energy sources), affordability (price affordability), and *acceptability* or *sustainability* (environmental acceptance and sustainability). Using this framework, it can be seen that China's energy strategy is not only aimed at meeting domestic needs but also serves as a geopolitical and global economic instrument. In terms of availability, China is working to ensure energy availability through massive renewable energy capacity development (Yergin, 2011). Data shows that in 2023, China added 263 gigawatts of new solar power capacity, or more than 60 percent of the global total. This scale enables China not only to meet its

growing domestic electricity needs, but also to potentially export energy technology and infrastructure to other countries, thereby creating global dependence on China's clean energy industry.

The dimension of *accessibility* is evident in how China dominates the global supply chain, for example by controlling more than 90 percent of the world's wafer and solar cell production and around 60 percent of wind turbine and electric vehicle manufacturing. This dominance allows China to not only secure energy access for its own people, but also puts other countries in a position where they must interact with China to obtain clean energy technology. In this context, energy security is no longer understood as merely control over traditional fossil resources, but has shifted to control over renewable energy technology and supply chains. This means that, through Yergin's framework, China has successfully repositioned itself from an energy-importing country vulnerable to global oil price fluctuations to a producer of clean energy technology that determines the direction of the world's energy transition.

The *affordability* dimension in Yergin's framework is evident in China's role in reducing global clean energy costs. The decline in the price of solar panels, batteries, and electric vehicles over the past decade has been greatly influenced by China's production scale and industrial policies that promote efficiency and price competition. For example, the cost of solar panel production has fallen by more than 80 percent in the last 10 years, largely due to China's massive manufacturing capacity. This has made renewable energy increasingly competitive with fossil fuels, both domestically and in the global market. From an energy security perspective, this affordability strengthens China's energy resilience by reducing its dependence on volatile fossil fuel imports, while also enhancing the international competitiveness of China's clean energy technologies. In other words, the affordability created by China not only provides domestic economic benefits, but also shapes a global energy market structure that is increasingly dependent on Chinese products and technologies.

Meanwhile, the dimension of *acceptability or sustainability* highlights environmental and sustainability aspects in China's energy strategy. The country's dominance in renewable energy development has significant implications for climate change mitigation, especially considering that China is still the world's largest carbon emitter. By achieving its 2030 renewable energy target six years ahead of schedule, China has demonstrated its strategic commitment to accelerating the energy transition while reducing its dependence on coal. In the context of energy security, this move can be interpreted as a long-term effort to reduce vulnerability to climate risks that could potentially disrupt economic and social stability. However, a paradox remains because even though the energy transition is happening rapidly, fossil fuel consumption is still very high. This indicates that sustainability in the Chinese context is still relative: on the one hand, strengthening domestic energy security through clean energy investment, while on the other hand still facing major challenges in reducing emissions in absolute terms (Lixia, 2021).

In the geopolitical dimension, Yergin's energy security theory helps explain how China's dominance in clean energy is reconfiguring the global energy security landscape.

Whereas in the past, energy security was understood more in the context of competition for fossil fuels, particularly oil and gas, today the center of competition has shifted to control of renewable energy technologies and their global supply chains. By controlling the majority of solar panel, wind turbine, and electric vehicle battery production, China not only ensures its own energy security, but also has a strategic instrument to influence other countries that depend on this technology. This situation shows that energy is no longer just an economic commodity, but also an instrument of power that can be used to strengthen bargaining positions in international relations.

Furthermore, China's dominance in clean energy challenges the traditional role of Western countries, especially the United States, which has long been the center of global energy innovation and security. The United States' response of imposing green tariffs on Chinese products shows that there is a dimension of "strategic competition" in the energy transition. Thus, through Yergin's lens, China's energy strategy can be understood as an attempt to reposition its national power in the global order, where control over clean energy technology functions similarly to control over oil in the 20th century. This also broadens the meaning of energy security from mere resource availability to mastery of technology and distribution chains that determine the future direction of the global energy transition. From the overall analysis, it appears that the clean energy transition in China not only represents a domestic effort to overcome the energy crisis and climate change, but also serves as a strategic instrument in shaping the global energy security order.

Through Daniel Yergin's theoretical framework, it can be understood that China has integrated the dimensions of *availability, accessibility, affordability*, and *sustainability* into its national energy strategy, making clean energy a pillar of security and geopolitical power. China's success in reducing the cost of green technology and dominating the global supply chain shows a shift in the center of gravity of energy security from fossil resources to renewable technologies. However, this dominance also creates a paradox: on the one hand, it accelerates the global energy transition, but on the other hand, it creates other countries' dependence on China's production capacity. Thus, China is not only securing its own energy needs, but also positioning itself as a key actor that will determine the direction, speed, and sustainability of the world's energy transition in the future.

CONCLUSION

With the continued increase in investment in the clean energy sector, China is further cementing its strategic position in strengthening energy security. Throughout 2024, the allocation of large funds to renewable energy, including solar power, electric vehicles, and energy storage, will not only serve as an instrument of climate transition, but also as a foundation for reducing energy import dependence and increasing domestic supply independence. Data shows that although the pace of investment growth has begun to slow, the total volume disbursed has reached the highest score in history, even nearly matching the total global investment in the fossil fuel sector. Thus, this strategy confirms that China's clean energy investment is not just an environmental project, but a long-term economic-political move to maintain national energy stability and sustainability,

while increasing the country's bargaining power in energy governance. This study shows that China has become a major actor in the global clean energy transition while reconstructing the concept of energy security. Through Daniel Yergin's framework, which emphasizes the four dimensions of availability, accessibility, affordability, and sustainability, China's energy strategy has proven to be aimed not only at meeting domestic needs but also at strengthening its geopolitical influence. In terms of availability and accessibility, China has secured its energy supply through large-scale renewable energy capacity and dominance of the global supply chain. In terms of affordability, mass production has lowered the price of green technology, making clean energy increasingly competitive. Meanwhile, in terms of sustainability, China has shown significant progress by exceeding its renewable energy targets ahead of schedule, despite still facing the paradox of being the world's largest emitter. Thus, China's dominance in clean energy marks a shift in the center of gravity of global energy security, from the scramble for fossil resources to the mastery of renewable energy technology. This position makes China not only the guardian of its own energy, but also the actor that determines the speed and direction of the world's energy transition.

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