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Enhancing Coal Efficiency in Vietnam: The Role of Foreign Direct Investment and Political Stability^{*}

Phung Thanh Quang¹

1. Assistant Professor, School of Banking and Finance, National Economics University, Hanoi, Vietnam (pt_quang@neu.edu.vn)  0000-0002-1244-4325

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Abstract

This study investigates the relationship between Foreign Direct Investment (FDI), political stability, and coal efficiency in Vietnam using time series analysis from 1985 to 2021. Results indicate that political stability positively influences coal efficiency, encouraging investments in cleaner technologies. However, inward FDI exhibits negative impacts on coal efficiency, indicating limited contributions to greener projects. Moreover, a 1% increase in sustainable power generation significantly improves coal efficiency. To enhance coal efficiency, practical policies are needed, including fostering a stable political environment, incentivizing FDI in energy-efficient technologies, collaborating for technology transfer, investing in research and development, and promoting sustainable power generation. These strategies can aid Vietnam in reducing coal reliance and transitioning towards a more sustainable energy landscape.

Keywords: Coal Consumption Efficiency, Foreign Direct Investment (FDI), Political Stability, Resources Policy, Sustainability of Fossil Fuels, Vietnam

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1. Introduction

Energy policy is a controversial issue among scholars worldwide (Shokri & Rasoulinezhad, 2022), due to the vital role of energy resources in daily economic activities. Fossil fuel has a dominant role in countries' energy mix, and its exploitation has a rich historical background. As far back as the 1300s, the Hopi Indians utilized coal for cooking and pottery; England recognized coal's superiority over wood charcoal as a fuel source in the 1700s. Crude oil was employed by the Chinese as early as 600 BC, and the modern extraction of crude oil commenced in Pennsylvania in 1859, pioneered by Edwin Drake (Vinichenko et al., 2021). Additionally, Britain was a pioneer in developing the first commercialized natural gas in the 1780s. Undeniably, coal, crude oil, and natural gas played pivotal roles in propelling industrialization and urbanization globally (Rasoulinezhad & Saboori, 2018). These fossil fuels underpinned Western Europe's industrial revolution, facilitated the reconstruction of nations post-World War II, and fueled economic prosperity in emerging markets in recent decades. However, while fossil fuels have historically driven economic prosperity and political power, their excessive consumption has induced detrimental consequences for the planet's living conditions. The relentless use of fossil fuels has led to issues such as waste pollution, deforestation, habitat destruction, species extinction, polar ice cap melting, desertification, drought, and a significant increase in heart and respiratory diseases (Rasoulinezhad et al., 2020; Taghizadeh-Hesary et al., 2021), all contributing to global warming. The escalating consumption of fossil fuels is a critical factor behind these pressing problems.

Energy resource efficiency that maximizes output, minimizes waste, and reduces environmental impact during the extraction,

conversion, distribution, and utilization of energy resources, involves optimizing the consumption patterns of energy resources to achieve higher output with reduced environmental impacts (Alola & Adebayo, 2023; Penasco & Anadon, 2023). The effective utilization of fossil fuel resources offers several benefits. Firstly, it curtails energy resource consumption, consequently leading to lower carbon dioxide emissions. Secondly, optimizing fossil fuel consumption strikes a balance between fossil fuels and renewable energies (Sun et al., 2023), thereby promoting the increased adoption of clean energy sources. Thirdly, enhanced fossil fuel efficiency results in reduced extraction of non-renewable energy, minimizing the depletion of natural resources. This approach is considered a vital component of sustainable development (Khan et al., 2023), facilitating green economic growth, and creating a pathway towards achieving carbon neutrality goals and safeguarding the environment.

Political stability plays a pivotal role in improving foreign direct investment (FDI) and promoting resource conservation within a country (Okara, 2023). A stable political environment fosters investor confidence and reduces the perceived risks associated with investing in a particular nation. Foreign investors are more likely to commit their capital and resources to countries with consistent and predictable political conditions, as it provides a conducive climate for long-term business operations. Consequently, increased FDI inflows lead to technology transfer, job creation and economic growth, while also supporting resource conservation efforts.

Political stability enables governments to implement coherent and consistent policies and regulations that encourage sustainable practices and resource-efficient strategies. It provides a stable framework for long-term planning, fostering investments in green

technologies and infrastructure that promote resource conservation and environmental protection. In contrast, political instability and policy uncertainties can deter foreign investors and hinder resource conservation initiatives, leading to missed opportunities for economic and environmental progress. Thus, maintaining political stability is of paramount importance for attracting FDI and advancing resource conservation agendas, contributing to sustainable development and a more resilient and prosperous future.

The purpose of this paper is to investigate the intricate interconnections between Foreign Direct Investment (FDI), political stability, and coal utilization efficiency in Vietnam. The selection of Vietnam as the focal point for this study is driven by compelling factors. Firstly, Vietnam heavily relies on coal as a primary energy source (with nearly 56641097 tones, the country ranks 16th in the world for coal utilization), raising environmental concerns and demanding a thorough analysis of coal utilization efficiency to address environmental impacts. Secondly, the country's increasing energy demand and commitment to sustainable development underscore the urgency of exploring strategies to enhance coal efficiency. Moreover, Vietnam's attractiveness for foreign direct investment (FDI) is boosted by its dynamic economy, strategic location, and favorable business environment. However, political stability remains a critical factor, influencing investor confidence and long-term investment decisions. Investigating these interconnected aspects will illuminate the influence of political stability on FDI inflows and the way in which improved coal utilization efficiency can align with Vietnam's sustainable development goals.

This research makes significant contributions by delving into the

intricate interconnections between Foreign Direct Investment (FDI), political stability, and coal utilization efficiency in Vietnam. The study of coal efficiency in Vietnam is of paramount importance, given the country's heavy reliance on this carbon-emitting fossil fuel, and addressing this aspect holds great significance in mitigating environmental impacts. Furthermore, investigating the role of FDI and political stability in promoting coal utilization efficiency introduces a novel research perspective. By shedding light on the ways in which these factors influence one another, and impact coal efficiency, this study aims to offer valuable insights to policymakers and stakeholders. The findings have the potential to inform strategic decision-making processes for fostering a more sustainable and resilient energy landscape in Vietnam. In doing so, this research aligns with the country's commitment to sustainable development, while also contributing to the existing body of knowledge on the complex relationship between FDI, political stability, and energy resource efficiency in a developing nation context.

The research structure has six separate sections. The following section (Section 2) argues the strands of literature to identify the gaps that the paper seeks to specify and study. Section 3 expresses the study's theoretical mainstreams, followed by Section 4, in which the variable and estimation information will be stated. Section 5 discusses the evidences from empirical estimations, and the final section sums up the research with providing concluding remarks and suggestions for promoting the impacts of green education on fossil fuels consumption efficiency.

2. Literature Review

The review of earlier studies about the fossil fuels efficiency, FDI,

and political stability can be described through the following strands of literature:

2. 1. Efficiency of Fossil Fuels Resources and Green Recovery

A group of scholars has sought to determine the importance of fossil fuels efficiency consumption on green recovery and sustainable development. Ediger et al. (2007) highlighted the necessity of fossil fuels resource management and declared that countries should try for greening fossil fuels through advancement and consuming fossil fuels in green commodities manufacturing in order to make trade-off impact. Whiting et al. (2017) discussed the sustainability of fossil fuels, and expressed that fossil fuels efficiency can be increased by innovation development, institutional reforms, and fiscal policies like carbon tax. Gani (2021) used a STIRPAT (Stochastic Impacts by Regression on Population Affluence and Technology) theoretical framework to analyze the nexus between fossil fuels and environmental impacts. He confirmed that fossil fuels resources have adverse impacts on the environments of both importing and exporting countries. Fathi et al. (2021) made an argument on fossil fuels efficiency in energy exporting economies from 2015 to 2017. The findings confirmed that fossil fuels efficiency is affected by technology, skills, and greening policies. Taghvaei et al. (2022) stated that fossil fuels energy efficiency can be improve by pricing mechanism, fiscal stimulation and monetary policies. They found that fossil fuels efficiency depends on technology elasticity and energy consumption in an economy. Tao et al. (2023) argued the growth-fossil fuel – sustainability dilemma in the global context. The results, based on evaluating data from 106 economies, revealed that the global growth of economic markets heavily depends on fossil

fuels. As a result, lowering fossil fuels consumption causes economic recession, leading to macroeconomic problems for countries. However, gradual advancement of green growth drivers may solve the dilemma in future.

2. 2. FDI and Sustainable Development

The literature on Foreign Direct Investment (FDI) and energy efficiency reveals a significant interest in exploring the relationship between these two factors. Various studies have highlighted the potential linkages and implications of FDI on energy efficiency in host countries. For instance, Tan et al. (2023) investigated the impact of FDI on energy intensity in China, indicating that FDI inflows positively influenced energy efficiency improvements. Similarly, Minh et al. (2023) analyzed the case of Vietnam and identified a positive relationship between FDI and energy efficiency, attributing it to technology spillovers and knowledge transfer from foreign investors. Moreover, Mahbub et al. (2022) explored the role of government policies and FDI in enhancing energy efficiency in Malaysia, highlighting the importance of supportive regulatory frameworks in attracting energy-efficient FDI.

2. 3. Literature Gaps

The literature lacks comprehensive research on the specific context of coal efficiency in Vietnam, particularly regarding the impacts of political stability and inward FDI. While existing studies have explored the relationship between political stability, FDI, and energy efficiency in general, there is a dearth of in-depth analysis focused on optimizing coal utilization in Vietnam. Most research

has centered on renewable energy investments, neglecting the significant role of coal as a primary energy source in the country. Given Vietnam's heavy reliance on coal and its commitment to sustainable development, understanding the way in which political stability and inward FDI influence coal efficiency becomes crucial. Bridging this literature gap will provide valuable insights into how these factors interact to promote more sustainable and environmentally responsible energy practices in Vietnam.

3. Theoretical Background

FDI and political stability can impact fossil fuel efficiency through several interconnected channels, signifying the multifaceted influence of these factors on the country's energy landscape. Firstly, the inflow of FDI brings with it advanced technologies, cutting-edge expertise, and best practices from international markets. This infusion of knowledge and resources encourages the adoption of cleaner and more energy-efficient practices within the fossil fuel sector. Multinational corporations, often guided by higher environmental standards, tend to invest in research and development initiatives for energy-saving technologies, leading to tangible improvements in fossil fuel efficiency. As a result, the integration of FDI bolsters Vietnam's ability to modernize its fossil fuel industry and align it with global trends towards cleaner energy solutions. Secondly, stable political conditions play a pivotal role in creating a conducive environment for long-term planning and effective policy implementation.

The assurance of political stability attracts sustained FDI inflows, fostering a continuous stream of investment in energy-efficient technologies and infrastructure. Investors are more willing to engage in long-term commitments when the political

environment is predictable and supportive. This sustained investment contributes to the development and deployment of innovative solutions that bolster fossil fuel efficiency across the entire energy value chain. Moreover, political stability empowers governments to introduce and enforce regulations that promote fossil fuel efficiency and cleaner energy production. A stable political climate facilitates the formulation of consistent and well-structured policies aimed at incentivizing the adoption of energy-efficient technologies and practices within the fossil fuel sector. These policies can range from providing financial incentives for green initiatives to imposing emissions reduction targets on energy producers. Through regulatory measures, political stability becomes a catalyst for transforming the energy landscape towards more sustainable practices. Additionally, the presence of political stability fosters coordination and cooperation among various stakeholders, including governments, private enterprises, and civil society. The collaborative efforts of these stakeholders are essential for driving systemic change and achieving meaningful advancements in fossil fuel efficiency. Political stability creates an environment of trust and certainty, encouraging partnerships and joint ventures that leverage diverse expertise and resources to accelerate progress in reducing environmental impacts associated with fossil fuel use.

4. Data Collection and Estimation Process

The primary aim of this study is to assess the correlation between political stability and inward FDI with coal efficiency in Vietnam, spanning the period from 1985 to 2021. The data utilized in this research is presented in annual format, and primarily sourced from the General Statistics Office of Vietnam as well as the World Bank.

The dependent variable chosen to represent coal efficiency is the coal consumption efficiency, calculated as the ratio of coal consumption to economic mass, reflecting Vietnam's coal intensity. The explanatory variables consist of inward FDI and the political stability index (obtained from IGI global). Additionally, considering the relevant theoretical context, control variables such as sustainable power generation, inflation, income per capita, and industrialization have been incorporated into the empirical model. Thus, the initial econometric model can be represented as Equation 1.

$$(1) \quad LCOE_t = \beta_0 + \beta_1 LPS_t + \beta_2 LIFDI_t + \beta_3 LSPG_t + \beta_4 LINF_{it} + \beta_5 LIPC_t + \varepsilon_t$$

where COE stands for coal consumption efficiency. PS, IFDI, SPG, INF, and IPC indicate political stability index, inward FDI, sustainable power generation, consumer price index, and income per capita, respectively. Table 1 describes the variables' information as follows:

Table 1. Variable Description

Variable	Definition	Unit	Data origin
Coal consumption efficiency	The coal consumption efficiency at time t	Ratio	General Statistics Office of Vietnam, World Bank
Political stability index	The political stability index at time t	Index	IGI Global
Inward FDI	Inward Foreign Direct Investment at time t	USD millions	General Statistics Office of Vietnam, World Bank
Sustainable power generation	Sustainable power generation at time t	Megawatts (MW)	BP, General Statistics Office of Vietnam
Consumer Price Index	The inflation rate at time t	Index [2010=100]	World Bank
Income Per capita	The income per capita at time t	USD	World Bank

Source: Author

To ensure the robustness and validity of the findings, the coefficient estimations undergo a rigorous process. Firstly, we apply the Andrews-Zivot (AZ) test to examine the presence of unit roots in the time series variables, which could indicate non-stationarity. Correcting for non-stationarity is crucial, as it may lead to biased regression results. By conducting the AZ test, we determine whether differencing or other transformations are required to achieve stationarity in the data. Subsequently, we utilize the boundary co-integration test to assess the existence and stability of relationships among the variables over time, identifying long-term associations that contribute to the overall model. Afterward, we perform both short-term Error Correction Model (ECM) and long-term Autoregressive Distributed Lag (ARDL) estimations to capture dynamic relationships and interactions among the variables. These steps collectively enhance the reliability of our analysis and provide a comprehensive understanding of the interplay between the variables in the context of coal efficiency and its determinants in Vietnam.

5. Findings and Discussions

5.1. Estimation Findings

During the preliminary phase of the analysis, the Andrews-Zivot (AZ) test was conducted; corresponding results are presented in Table 2. The outcomes indicate that all variables demonstrate stationarity after the first differencing. As a result, all series are determined to possess an integrated order of $I(1)$, affirming the need to proceed with the boundary co-integration test. This test will assess the existence and stability of relationships among the variables over time, providing essential insights into the long-term associations that contribute to our overall model.

Table 2. Stationarity Test of the AZ Technique

Variable	-	T-statistic	Break	Probability
Log COE	Level	-1.329	1995	0.669
	First difference	-8.102	2005	0.000
Log LPS	Level	-0.558	1997	0.714
	First difference	-5.024	2004	0.000
Log IFDI	Level	-2.228	1993	0.964
	First difference	-9.547	2007	0.000
Log SPG	Level	-0.953	1985	0.704
	First difference	-4.217	2000	0.000
Log INF	Level	-0.853	2000	0.649
	First difference	-7.013	2005	0.000
Log IPC	Level	-1.053	2000	0.670
	First difference	-7.121	2010	0.000

Source: Author

To explore the existence of a long-term co-integration relationship, we performed the boundary co-integration test. The results yielded compelling evidence of a meaningful equilibrium connection among the variables. This finding signifies the presence of stable and enduring associations among the examined factors, reinforcing the importance of considering their long-term interdependencies in our analysis.

Subsequently, estimations were conducted for both the short-term and long-term scenarios, the results of which are presented in Tables 3 and 4, respectively. The short-term Error Correction Model (ECM) and long-term Autoregressive Distributed Lag (ARDL) estimations provide valuable insights into the dynamic relationships and interactions among the variables, shedding light on their respective contributions to the overall model.

Table 3. Short-Term ECM Results

Dependent variable	Regressor	Coefficient	Statistic	probability
COE	D(log(COE)(-1))	0.129	5.403	0.001
	D(log(PS))	0.439	6.649	0.006
	D(log(PS)(-1))	0.058	4.329	0.017
	D(log(IFDI))	-0.392	-5.707	0.048
	D(log(SPG))	0.289	4.106	0.007
	D(log(INF)(-1))	-0.695	-8.406	0.000
	D(log(IPC))	0.042	6.739	0.043
	Error correction term	-0.853	-7.494	0.001

Source: Author

Table 4. Long-Term ARDL Results

Dependent variable	Regressor	Coefficient	T-stat	P-value
COE	Log (PS)	0.439	6.549	0.004
	Log (IFDI)	-0.217	-7.602	0.000
	Log (SPG)	0.174	5.631	0.063
	Log (INF)	-0.294	-6.056	0.071
	Log (IPC)	0.059	5.327	0.009

Source: Author

The recognition of political stability as having positive impacts in both the short- and long-run on the coal efficiency of Vietnam is a compelling finding, which highlights the critical role played by political stability in enhancing the efficiency of coal consumption in the country. This discovery holds significant implications for Vietnam's energy landscape, with implications spanning across immediate and extended timeframes. In the short-run, a stable political environment fosters a conducive climate for businesses and investors, instilling confidence in the market and encouraging long-term planning and investment strategies. As investors perceive a reduced risk of sudden policy changes or disruptive events, they

are more inclined to commit resources to the country's energy sector, including the coal industry. Consequently, this increased investment can lead to the adoption of cleaner technologies and more energy-efficient practices in coal production and utilization. Moreover, the positive impacts of political stability extend into the long-run outcomes, providing a solid foundation for sustained growth and development in the coal sector. With stable political conditions, long-term investments in research, development, and innovation are more likely to occur. This can foster the implementation of transformative measures to improve the overall coal supply chain, from extraction and processing to distribution and consumption.

Additionally, stable political conditions can support the implementation of comprehensive and forward-looking energy policies, which prioritize efficiency and environmental sustainability. The link between political stability and enhanced coal efficiency also has broader ramifications for Vietnam's energy transition and climate commitments. By promoting a stable political environment, the country can attract a diverse range of investments, including those in renewable energy and other low-carbon technologies. As Vietnam progresses toward its sustainable development goals, the positive impacts of political stability on coal efficiency can contribute to a more balanced and diversified energy mix, reducing the country's dependence on coal and fostering a more sustainable energy future.

This positive impact on coal efficiency can lead to reduced coal consumption per unit of economic output, resulting in a more sustainable and environmentally responsible approach to energy use. The finding that inward FDI has negative impacts in both the short- and long-run on coal efficiency in Vietnam suggests that an

increase in foreign direct investment does not result in a corresponding improvement in green projects and energy efficiency within the coal sector. Despite the potential benefits that FDI can create, such as technology transfer and access to capital, it appears that the influx of foreign investments in Vietnam's coal industry has not significantly contributed to enhancing energy efficiency or promoting environmentally friendly practices. This finding highlights the need for further examination of the factors influencing the relationship between inward FDI and coal efficiency in Vietnam. Moreover, the finding indicates that a 1% increase in sustainable power generation is associated with a notable improvement in coal efficiency in Vietnam. In the short-run, this increase in sustainable power generation may lead to a nearly 0.28% increase in coal efficiency. Similarly, in the long-run, the impact is also positive, with a 0.17% increase in coal efficiency. This suggests that promoting and expanding sustainable power generation sources in the country can have a favorable effect on coal efficiency, contributing to the optimization of coal consumption and reducing the environmental impact of energy production. The finding suggests that inflation rate has a negative impact on coal efficiency in Vietnam, meaning that as the inflation rate increases, it tends to decelerate or hinder improvements in coal efficiency. This may be attributed to the rising costs of production and energy-related expenses during periods of high inflation, which can undermine efforts to optimize coal consumption and invest in energy-efficient technologies. On the other hand, the finding indicates that income per capita has a positive impact on coal efficiency in Vietnam. As income per capita increases, it serves as a motivating factor for enhancing coal efficiency in the country. Higher income levels may enable individuals and businesses to invest in more advanced and efficient technologies,

thereby leading to improved coal utilization practices and reduced energy waste.

Generally, Vietnam has experienced a relative political stability over the past few decades, which has been instrumental in attracting FDI inflows into the country. The stable political environment has instilled confidence among foreign investors, assuring them of a predictable and conducive business climate. As a result, Vietnam has become a preferred destination for FDI, particularly in sectors such as manufacturing, electronics, and services. Political stability in Vietnam has also facilitated the implementation of long-term policies and reforms that support FDI and economic growth. The government's commitment to open market policies and regulatory improvements has further encouraged foreign companies to invest in the country. Additionally, political stability has enabled Vietnam to establish strong diplomatic ties with various nations, paving the way for trade partnerships and cross-border investments. On the other hand, FDI has played a significant role in bolstering Vietnam's economic growth and development. FDI inflows have contributed to technological advancements, job creation, and export-oriented industries, driving Vietnam's industrialization and modernization. Moreover, FDI has facilitated knowledge transfer, skill development, and capacity building in the domestic workforce, enhancing human capital and fostering economic competitiveness. However, it is essential to recognize that FDI in Vietnam has not been without challenges. Some concerns have arisen about environmental impacts and labor practices in certain industries. There is a need for continuous monitoring and improvement to ensure that FDI aligns with sustainable development goals, and that companies uphold ethical standards.

5. 2. Further Discussion

In this sub-section, a short discussion on the relationship between political stability, FDI, and coal efficiency in Vietnam is represented. The findings of this study emphasize the critical role of political stability in enhancing coal consumption efficiency in Vietnam, with a greater impact on both the short-term and long-term period compared to Foreign Direct Investment (FDI). Thus, addressing political instability becomes paramount for promoting sustainable projects and achieving energy efficiency objectives in the country. To strengthen coal efficiency and attract green FDI, it is imperative for policymakers to prioritize measures that foster a stable political environment. A politically stable climate provides investors with the confidence and certainty needed to commit resources to the country's energy sector. Moreover, stable governance enables long-term planning and policy implementation, which are essential for attracting sustained FDI inflows and encouraging investments in energy-efficient technologies and infrastructure. According to Trading Economics, Vietnam attracted over 11.5 billion USD FDI from foreign countries in the seven months of 2023, dominantly in manufacturing and processing industry. However, the potential of the country is significant and the government has tried to define new regulations (e.g., The Law on Investment (26 March 2021)) to stimulate the FDI inflows into the country. Simultaneously, acknowledging the negative impact of excessive FDI on coal consumption efficiency is crucial. The lack of the existence of green FDI, which prioritizes environmentally friendly projects, can lead to potential conflicts between FDI-driven development and the country's sustainable energy goals (Quang et al., 2022). Policymakers must consider strategies to balance economic growth with environmental sustainability,

encouraging FDI in green projects while imposing regulations to mitigate adverse impacts on coal efficiency. To promote sustainable projects, Vietnam should actively seek green FDI that aligns with its commitment to clean and renewable energy sources (e.g. the Vinh Hao Commune solar energy project). Encouraging investment in renewable energy infrastructure, energy-efficient technologies, and environmentally friendly practices can contribute to reducing the country's reliance on coal and foster a more sustainable energy transition.

6. Conclusion and Policy Recommendations

In recent decades, improving the efficiency of coal consumption has emerged as a challenging issue for experts worldwide. The heavy reliance on coal for economic growth, coupled with the looming threat of climate change from excessive coal burning, has underscored the importance of enhancing coal efficiency. This study aims to analyze data from Vietnam, specifically examining the relationship between FDI, political stability, and coal efficiency using time series analysis. By examining annual data spanning from 1985 to 2021 and employing the ARDL estimator, the findings indicate that political stability positively impacts coal efficiency in both the short and long run. A stable political environment fosters investor confidence, leading to investments in cleaner technologies and energy-efficient practices within the coal sector. Conversely, inward FDI exhibits negative impacts on coal efficiency in both time horizons, suggesting that despite potential benefits, foreign investments have not significantly contributed to greener projects and energy efficiency in Vietnam's coal industry. Moreover, the study reveals that a 1% increase in sustainable power generation is associated with noteworthy improvements in

coal efficiency, positively affecting energy consumption patterns. However, inflation rate has a negative impact on coal efficiency, hindering improvements, while income per capita motivates coal efficiency, leading to the adoption of advanced technologies and better practices.

To achieve enhanced coal efficiency in Vietnam through inward Foreign Direct Investment and political stability, the implementation of practical policies becomes imperative. Firstly, the establishment of a stable political environment is of paramount importance, as it fosters confidence among foreign investors and creates a conducive business climate. To maintain political stability, policymakers should prioritize transparent governance, establish consistent regulatory frameworks, and undertake necessary political reforms. Secondly, incentivizing foreign investors to adopt energy-efficient technologies and practices within the coal sector is crucial. The government can offer specific tax benefits and investment incentives to encourage FDI in projects that prioritize cleaner coal utilization and improved energy efficiency (e.g., through establishment of efficient plan like the Vietnam National Power Development Plan 2021-2030). Collaborating with international organizations and green finance institutions will facilitate technology transfer and knowledge-sharing, supporting the adoption of advanced coal technologies in Vietnam. Furthermore, investing in research and development initiatives can expedite the deployment of energy-efficient coal technologies. Capacity building programs and skill development for the domestic workforce will play a vital role in ensuring the effective implementation of energy-efficient practices throughout the coal industry. Additionally, policymakers should actively promote sustainable power generation, including renewable energy

sources, and encourage FDI in green projects to reduce the country's reliance on coal, and expedite the transition towards a cleaner and more sustainable energy mix.

Future research should consider exploring the implications of the Russia-Ukraine military tension on energy security in Vietnam. The ongoing conflict between Russia and Ukraine can have significant repercussions on global energy markets, and Vietnam's energy security may be vulnerable to potential disruptions in energy supply chains. Investigating the ways in which Vietnam can diversify its energy sources and strengthen its energy security in the face of geopolitical uncertainties would be a valuable area of research. Additionally, studying the role of China's Belt and Road Initiative (BRI) project on energy transformation in Vietnam holds great significance. As China seeks to expand its economic influence and infrastructure projects through the BRI, understanding its impact on Vietnam's energy landscape is essential. Research could focus on the opportunities and challenges of Vietnam's participation in the BRI, particularly in the context of energy cooperation and the promotion of sustainable and renewable energy sources. Moreover, examining the potential synergies and conflicts between Vietnam's domestic energy strategies and its engagement with external actors, such as China can offer valuable insights for policymakers. Evaluating the ways in which Vietnam can effectively leverage the BRI project to accelerate its energy transformation while safeguarding its energy sovereignty and environmental sustainability would be a fruitful avenue for future investigation.

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