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The Economic Impacts of Climate Policy and the Green Transition in the United Kingdom: A Quantitative SEM Analysis

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Abstract

The green transition, driven by national agreements and international terms such as the Paris Agreement, focuses on reducing carbon emissions and promoting renewable energy. Governments worldwide are introducing climate change mitigation policies and building low-carbon economies. However, these changes also cause massive economic disruptions, especially in those industries dependent on fossil fuels. The study aims to analyze the economic impacts of climate policy and green transition, focusing on their effects on the UK economy. It utilized a quantitative research design, where it surveyed 250 respondents in industries that were most influenced in the UK by climate policy measures. Smart PLS was used to apply SEM and CFA to the relationship between climate policy, green transition, and economic growth. The findings suggest that, even though both the green transition and the climate policies positively affect economic growth, the impact of green transition on economic development is much greater than that of climate policies. In particular, the green transition was derived to impact economically, the renewable energy and clean technology sectors strong direct effect, whereas climate policy effects had more moderate impacts. It contributes towards empirical evidence on the relative effects of climate policies and green transition initiatives on the economic development in the UK. It also identifies the threats and opportunities of the green transition, especially in fossil fuel-intensive industries and the necessity of balanced policy solutions helping environmental objectives and economic sustainability simultaneously.

Keywords: *Climate Policy; Green Transition; Fossil Fuel; Economic Impact*

JELClassification: *F1, F12, F60*

1. Introduction

The movement toward a green transition has gained momentum, with the world becoming more agitated about climate change than ever. Climate policies are now more prominent in domestic agendas given that international agreements encourage such practices, as with the Paris Agreement, which seeks to ensure temperatures do not climb considerably further than pre-industrial levels (Dovie and Lwasa, 2017).Governments of various countries are currently planning and implementing measures that allow them to decrease the level of carbon emissions, increase the use of renewable resources, and develop economies that are not heavily dependent on carbon. As per Abbasi et al. (2024), the green transition refers to the shift of the economy from fossil fuels as the primary energy source to a sustainable innovation and development of technologies for climate change mitigation and adaptation. This is not just about the environmental issue, but an economic one with implications for industries, employment, and markets comprehensively across the globe. For this reason, measures like carbon policy, renewable energy, efficiency policies, and emissions have become unpopular across world governments and other policymaking institutions (Green and Gambhir, 2020). According to Onukwulu, Agho, and Eyo-Udo (2021), these include policies set to promote green technology, encourage the development of clean energy industries, and reduce carbon footprint in large industries such as energy, manufacturing, and transport, among others.

Consequently, the effects of these policies are not solely confined to the economic aspect of the economy. On the one hand, the green transition is expected to open new opportunities for developing renewable energy sources, electric and other types of transport, effective energy-saving technologies, and other sustainable sectors (Saleh and Hassan, 2024). For example, for the International Renewable Energy Agency (IRENA), perhaps we can count on 85 million plus jobs that can be envisaged in the renewable energy sector by 2030 (IRENA, 2023). On the other hand, García-García, Carpintero, and Buendía, (2020) argued that industries that utilize fossil fuels experience a considerable level of disruption in not only job losses, economic shifting, and inequalities but also in shifting their operational margins into a low-carbon economy. However, such a green transition affects the climate through pollution policies and the economic society. Due to the ideals set up by the government to limit emission levels, global economic effects are presumably seen at infrastructures involving the allocation of hefty consequences to industries in fossil fuels, agricultural lands, and transport systems.

Climate policy and the transition to a green economy provide many challenges. For this reason, policies that can help address climate change and its impact, especially reducing carbon emissions, always entail a social cost (Markkanen, and Anger-Kraavi, 2019). Climate change policies deepen the division between the rich and the poor, developed and developing nations, as firms relying on fossil energy sources might lose their jobs, experience the rise of energy prices, and need to adapt to new policies (Puyo et al. 2024). On the other hand, green transition proponents posit that the green transition can generate economic growth, generate new jobs, and advance technology (Söderholm, 2020). However, as far as they are implemented, environmental policies that address sustainable development and social justice have not been a subject of keen debate. It has become increasingly accepted that policies to address climate change do not affect everyone in the same way. As an example, it would be possible to mention the participation of the UK in the Paris Agreement (Dovie and Lwasa, 2017) and its bold climate targets, underlining the topicality of the green transition to the UK. Besides this, the introduction ought to have a clearer statement of the research gap, which is the inquiry of the absence of in-depth empirical research on the economic impact of climate policies and the green change in the UK. By determining this gap at the beginning of the section, the reader is able to comprehend more about the necessity of this research. Moreover, it would be more efficient to cluster similar ideas, i.e., the economic consequences of climate policies, the difficulties confronting fossil fuel-intensive industries, and the current policy discussions to establish a logical structure which logically leads to the goals and contributions of the study (Green & Gambhir, 2020). A more organized solution would also assert the need to balance between environmental objectives and economic sustainability where the green transition will support sustainable growth without making the regions more unequal.

The rationale for focusing on the economic effects of climate policies and the green shift is that public policies ought to be grounded on science. While the governments analyze the ways and the goals for achieving climate objectives, it is imperative to consider the cost of the actions for avoiding negative impacts on the climate as well as the goals and objectives for the green transformation for making the process both green and financially and socially feasible. This paper illustrates that stakeholders in the public, business, and government sectors need to realize the cost and benefit of green economy. The papers have shown that the green transition is a continuous process that influences various aspects of the economy. Thus, the examination of climate policy can help to identify various effects of climatic change on employment, economic growth, industrial competitiveness, and social well-being. If the economics of climate policies is not evaluated adequately, then it will result in negative economic effects on the economy such as loss of jobs in industries that rely on fossil fuel, market fluctuations and income disparity. Therefore, the study aims to analyse the economic impacts of climate policy and the green transition, with a focus on understanding the complex relationship between environmental policies and economic outcomes. The findings will be useful for understanding the role that climate policy and the green transition play in shaping the growth and development of the UK economy.

2. Literature Review

2.1. Economic Effects of Climate Policy and the Green Transition

The economic effects of the climate policy and the green transition are extensive affecting wide range of sectors, ranging from production to industrial practice. With increased global fears of climate change, devoted policies to mitigate have grown in the agenda at the domestic and international levels. As per Huang, and Zhai (2021), The Paris Agreement which is targeted at limiting global temperature rise has triggered the growth of low carbon economies. A key significant area to focus is the transition to renewable energy from fossil fuels due to government activities to check carbon emission (Kalair et al. 2021). Such a shift has brought opportunities in renewable energy and green technologies because as the International Renewable Energy Agency estimates (IRENA, 2023) projects an increase in number of jobs by 2030. According to Dirma et al. (2024), the growth of renewables promising prospects for economic development based on the development of sectors, such as solar, wind, and electric transportation. However, such opportunities are not void of challenges. Fossil fuel based industries like coal, oil and natural gas are very sensitive to the economic forces resulting from the climate policies. According to Fattouh, Poudineh and West (2019), oil-exporting countries and businesses are confronted with enormous adaptation problems considering the transition into cleaner sources of energy. Therefore, areas which have developed their economy on such energy sources experience economic lethargy and with grave repercussions on employment and regional growth (Green and Gambhir, 2020).

Other climate policies such as carbon pricing, emissions reduction renewable energy incentives are also important in the direction of the economy to a sustainable future. Rentschler, Kornejew, and Bazilian (2017) mention, that these policies frequently have their price in the short-term. The elimination of fossil fuel subsidies and the increase in energy prices can put a financial burden on the business and the household that are mostly skewed to low-income regions and populations. This change, according to Markkanen and Anger-Kraavi (2019), can widen social inequalities, especially in those areas where the industries based on fossil fuels remain the core of the local economy. The research by Mackay et al. (2025) supports that the success of climate policies does not only depend on their effect on the environment, but also the economic change that is necessary to carry out a smooth and fair change from climate policies. Thus, the policymakers will need to embrace comprehensive approaches that will reconcile the environmental missions with economic growth, as well as the social costs of such transformational changes.

2.2. Energy Transition Challenges

The green transition is a shift from dependence on fossil fuels to renewable energy sources, holds key implications shaping global markets and industries. Sayed et al. (2023) discussed that, the use of renewable energy technology, including wind, solar and energy storage system, is key in economic growth. Such advancements not only support sustainable development but also create new working places for goods and services, thus minimizing the energy costs and increasing the sources of energy (Dirma et al., 2024; Kalair et al., 2021). As per Islam, (2023), in a move for industries to accommodate greener practices; Energy technologies innovation has become a critical economic driver. The emerging renewable energy market provides the opportunity for businesses to diversify and invest in cleaner technologies in order to promote economic resilience and adaptation to climate change. However, it is also a transition that is accompanied by challenges especially for economies that depend on fossil fuel. Countries depend significantly on exportation of fossil fuels experience economic vulnerability arising from the shifting global demand and market trends, and the need to put in strategic practices to mitigate the changes (Fattouh et al., 2019). Moreover, moving financial resources around in order to guarantee just transition is very important in minimizing possible inequalities between nations and communities (Green and Gambhir, 2020).

Economic affairs of the green transition are also characterized by the necessity for all-around policies to handle the social consequences of such a change. While the labor market is changing, there are concerns pertaining job displacement in the traditional energy sectors. When the transition is not supported by specific policies, it may aggravated the social inequalities, especially, in those communities that are highly dependent on the fossil fuel industries. With skills required in the renewable energy sectors requiring specialization, there might be need for workers retraining, which can be a challenge or opportunity for economic diversification (García-García et al., 2020). In addition, rifts in the ability to finance green infrastructure at the global levels also exacerbate the transition. Certainly, developing countries experience such barriers in obtaining the necessary sources of money, to implement the renewable technologies. The elimination of these disparities is

crucial to bring about the equitable distribution of the green transition to all countries. All in all, although green transition has enormous economical potentials, it still can be accompanied by certain thoughtful policy interventions to implement a balanced, fair, and sustainable transformation towards low carbon economy (Puyo et al., 2024; IRENA, 2023).

3. Theoretical Framework

The Energy transition theory examines the intricate relationship that comes with transition from fossil fuels into renewable sources of energy. The transition is essential to meeting global climate objectives including Paris agreement and comprises of technical, economic and social transformations. Huang and Zhai (2021) state that to achieve the temperature goals of the Paris Agreement, far-reaching transitions should be made among societies, focusing on the carbon neutrality by the middle of the century. According to the theory, energy transitions cannot only be technological but systemic ones that should start from the energy, industry, and transportation sectors (Söderholm, 2020). An aspect that is a significant part of this theory is the contribution of renewable energy development towards economic growth. According to Dirma et al. (2024), the expansion of renewable energy does not only combat climate change but also helps in job presentation and the economy expansion specifically in the renewable energy industry. But the transition is, however, also a challenge, especially for economies that are highly dependent on fossil fuels. As Fattouh, Poudineh, and West (2019) indicate, oil-exporting countries and companies need to adjust to the energy market that is becoming more oriented toward the renewable sources, meaning a change of the business models and strategies. In this aspect, transition assistance policies are very important in mitigating social impacts of energy transitions and leaving workers from and regions that rely on fossil fuels behind (Green and Gambhir, 2020). Therefore, the Energy Transition Theory has placed a high level of emphasis on an even-handed approach that covers both environmental sustainability, and economic strength, calling for an all-inclusive approach that incorporates policy reforms, technological advancement, and social backing, to ensure long-term energy solutions for the people.

4. Methods

The study employs quantitative research strategy to analyze the effects of climate policy and the green shift on economic growth and development. The key variables of the study includes measures like carbon prices, intended emission reductions, and subsidies for renewable energy as well as green transition initiatives on GDP, employment, and investments. The objective of this approach is to establish the relationship between climate policy and the green transition, and the economic growth and development. Therefore, the study seeks to employ quantitative-based research to estimate the impact that climate policies have on macroeconomic factors for different sectors in the UK.

A total of 250 participants are recruited through a convenience sampling method, to get a large number of participants for the study. The rationale for this sampling method is suitable for this study because it helps to identify a sample group easily, quickly and comprises participants drawn from sectors (Emerson, 2021). The sample comprise the industries, policymakers, and the interested parties from the energy, transportation, manufacturing, and agriculture industries, because these sectors are generally affected by the application of climate policies. The primary data is going to be collected from an online questionnaire to these respective professionals so that their response ensuring to be authentic and reflecting the actual experience of the economic implications of climate policies in the UK. The survey had questions that indicated how the participants perceived the climate policy, the green transition efforts, and its economic effects. Questions were created to measure the level of awareness concerning climate policies, industry-related issues, and the expected positive outcome of renewable energy usage, both in terms of direct and indirect economic impacts.

Although convenience sampling is efficient and easy to implement since it requires little time and money that might lead to sampling bias due to sample size is not necessarily an accurate representation of the population of stakeholders impacted by climate policy. However, the sample is sufficiently broad enough to provide some insights on the economic impacts of climate actions in the UK. Convenience sampling can be biased in its sampling: It does not propose to represent the population of all the sectors influenced by climate

policy. Additionally, it restricts the generalized ability of results to other population groups beyond the sampled industries.

The independent variables for this study are climate policy and the green transition, which are both crucial to the objectives of the study. On the other hand, climate policy involves policies that seek to curb emissions, encourage the use of clean energy forms, and transform industries from the use of fossil energy sources serving as dependent variable. The study used Smart PLS to examine the relationship between climate policies, the green transition and economic growth. Tradeoffs between statistical test robustness and computational efficiency made Smart PLS a preferred tool for generating descriptive statistics, owing to its capacity for more complicated modeling with several constructs and relationships especially when the sample sizes are relatively small. SmartPLS was chosen due to its ability to handle complex models and investigate formative and reflective constructs and with a smaller sample size, it could still investigate relationships between multiple variables.

The hypothesized relationships among the constructs such as climate policy, green transition, and the economic development was tested using Structural Equation Modeling (SEM). The data were tested using confirmatory factor analysis (CFA) to confirm reliability and validity of the constructs. SmartPLS allowed for the identification of the direct and indirect effect between climate policy, green transition and economic outcomes.

5. Results

Table 1: Reliability and Convergent Validity Testing

Constructs	Indicators	Factor Loadings	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Carbon Emission	CP1	0.899	0.921	0.941	0.76
	CP2	0.861			
	CP3	0.893			
	CP4	0.884			
Green Transition	GT1	0.884	0.918	0.939	0.755
	GT2	0.884			
	GT3	0.910			
	GT4	0.812			
	GT5	0.851			
Economic growth and Development	EGD1	0.823	0.88	0.918	0.737
	EGD2	0.867			
	EGD3	0.905			
	EGD4	0.836			

The research in this study uses CFA to determine reliability and convergent validity of the measurement model. As noted by Brown (2015), confirmatory factor analysis is an important tool for validation of constructs through both discriminate, convergent, and reliability measures. The study used Cronbach's alpha as well

composite reliability to measure the latent variable reliability and Kline (2023) proposed for 0.7 as the minimum threshold for these indicators. The data found in table 1 shows the internal measuring quality of the applied items based on reliability and convergent validity tests. The tools of measurement show good internal consistency according to Cronbach's alpha, because all of the constructs Carbon Emission (0.921), Green Transition (0.918), and Economic Growth and Development (0.880) are above the minimum criterion of 0.7. Also, the composite reliability value for these constructs confirms their reliability as well: Carbon Emission (0.941), Green Transition (0.939), and Economic Growth and Development (0.918) have crossed the necessary threshold of 0.7, ensuring the firmness of the measurement model.

As per Latan, Noonan, and Matthews (2017), indicators which are considered as valuable should have factor loadings exceeding 0.6. The table 1 shows factor loadings for Carbon Emission are between 0.861 and 0.899, Green Transition is from 0.812 to 0.910 and economic growth and development from 0.823 to 0.905. This analysis confirms that all the indicators will indeed be able to reflect their respective constructs and provides validities to prove that the constructs are well measured. Moreover, The AVE values for all constructs including Carbon Emission (0.76), Green Transition (0.755) and even economic growth and Development (0.737) exceeds the threshold. These results support the fact that the measurement model creates high level of convergent validity and all constructs explain a significant part of variance in indicators. With this, the measurement model for this study has been seen to show consistency both in terms of reliability and validity.

Table 2:Discriminant Validity

Constructs	Climate policy	Economic growth and Development
Climate policy		
Economic growth and Development	0.709	
Green Transition	0.770	0.803

In this research, the Heterotrait-Monotrait (HTMT) ratio was used to measure discriminate validity of the constructs. In accordance with Wong, (2011), for the valid discriminate validity to be attained, the HTMT ratios need to be below the 0.85 threshold, which should also ensure that the constructs are not similar and avoid multi co-linearity risks. Table 2 illustrates the discriminate validity of the model because all HTMT ratios are far below the critical value of 0.85. Climate Policy and the relationship between Economic Growth and Development are associated at a moderate level of correlation with 0.709, while maintaining their independent identities. The coefficient associated with the relationship between Climate Policy and Green Transition is 0.770 that leads to seeing them as strongly connected but still separate conceptually. The value of the correlation between Economic Growth and Development and Green Transition is very high, 0.803, which even confirms the idea that although these constructs are strongly connected the fact is that they measure different aspects of sustainability and economic growth. The outcomes indicate that, though the constructs have great relationships with each other, each of them contributes uniquely in the whole model. Additionally, the results of the HTMT analysis support that the constructs of Climate Policy, Economic Growth and Development, and Green Transition have remained separate and contribute uniquely to the research model.

Table 3: Structural Model

	Sample mean	T-statistics	P values
Climate policy -> Economic growth and Development	0.187	3.280	0.001
Green Transition -> Economic growth and Development	0.645	10.345	0.000

Table 3 displays the outcome of structural model analysis that presents the sample means, T-statistics and p-values between the relationships: Climate Policy, Green Transition, and Economic Growth and Development. A study sample mean of 0.187, a T of 3.280 and a p-value of 0.001 are exhibited in the path from Climate policy to economic growth and development. These results are therefore statistically significant, positive, meaning that climate policy has a moderate impact on economic growth. The value of T-statistic at 3.280 is greater than the value for significance, which proves that the impact of climate policy on economic growth is statistically significant. However, the moderate sample mean indicates that the green transition has a stronger impact on economic growth than the climate policy.

The other path from Green Transition to Economic Growth and Development is, however, far more powerful with a sample mean of 0.645 and a T-statistic of 10.345 (p-value = 0.000). The fact that these results show high positive correlation between the green transition and economic development implies a very significant correlation. 10.345 T-statistic value regains that the green transition has a significant effect on the economic growth against a critical threshold. At the same time, the studied facts emphasize the key role played by sustainable practices in promoting long-term economic growth, which in turn requires policies that ensure green transitions for more economic gains.

Table 4: Predictive Relevance and Quality Assessment

	R-square	**R-square adjusted**
Economic growth and Development	0.624	0.621

The constructs leveled in this research present to us the extent at which the model can account for a substantial proportion of the variance in Economic Growth and Development. As is evidenced by a Coefficient of Determination of 0.624 (which according to statistics means that the model explains 62.4% of the variance in Economic Growth and Development), there is a strong correlation between the variables. This means that the independent variables of the model have a significant influence on the economic issues within the focus of the study. But 37.6% remains unexplained which implicates that there are other external factors excluding in this model which also can affect the economic growth.

The value of model efficiency in explaining the variance of Economic growth and development is shown by 0.621 adjusted R-squared value while accounting for the predictors used in the model. This altered value is a confirmation that the model does well considering the complexity of the predictors and a good fit to the data. This suggests the predictive relevance of the model though further research is needed to investigate other variables that could explain why there is unexplained variance in Economic Growth and Development.

6. Discussion

The results of this study offer major insights with regard to the linkage between climate policy and the green transition on economic development. The model produced in this research suggests that the climate policy and the green transition are effective for the results in the economy, i.e., economic growth and development. This is in-line with several previous studies (Green and Gambhir, 2020) that discovered that transitional assistance policies for the low-carbon transition positively influence economic growth, leading to the establishment of new sectors/jobs in the green economy. Just as the results of the study indicate that climate policies are significant in attaining environmental objectives, they can also play a big role in transforming the economy, especially in the case of energy, manufacturing, and transportation sectors. Consistent with the existing literature, this study also draws attention to the issues concerned with the green transition especially, areas or industries that rely heavily on fossil fuels. In their article, García-García, Carpintero, and Buendía (2020) write about the disruption, loss of jobs, and inequality that companies that depend on use of fossil fuels face due to the move toward low-carbon economies. As the previous study results show, the same dilemma that the companies encounter the need to reconcile the necessity of improvements in inventory management with

sustainability goals the unintended growth of emissions and costs. This indicates that, in spite of the opportunities presented by the green transition, it also creates a raft of complex trade-offs which policymakers will need to negotiate to get the transition right in terms of being just and equitable to the industries being impacted.

Green transition has resulted in huge opportunities in the UK and this has been witnessed especially in the renewable energy sector. Offshore wind industry in the UK is an example, where the fast growth of this sector has led to creation of jobs and economic growth. Nevertheless, places like the North East, which have long been dependent on fossil fuel sectors, struggle, among other things, with the loss of employment and financial disturbance. These adversities underscore the importance of specific transition policies, including retraining and green technologies investment to restraint the adverse effects on fossil reliant industries. Green transition has proved to have a greater impact on economic growth relative to climate policies in isolation since it promotes long-term development of new sectors such as renewable energy and electric vehicle transportation (Fattouh et al., 2019; Green & Gambhir, 2020). Policymakers need to concentrate on the industry-specific effects and introduce measures that facilitate the maintenance of the environment, as well as economic stability.

Moreover, the study also points to the necessity of aligning climate efforts with broader economic findings as discussed by Mackay et al. (2025), as the authors mentioned that most climate strategies do not provide appropriate solutions to economic and social outcomes. In this case, this study's findings indicate that although green transition efforts positively impact economic growth, they are not without economic cost, especially in the short term. This is consistent with the views of Rentschler, Kornejew, and Bazilian (2017), who propose that eliminating fossil fuel subsidies and consequent changes in energy prices present a substantial challenge to businesses and individuals. The findings of this study support a full-blown climate policy that considers the bigger scheme of the economy, the other economic policies that may need to be put in place to aid industries and regions that may be negatively affected by the process of change. It can be concluded that the research revealed in this paper can be counted among those trends in research work that highlight the importance of a balanced approach to climate policy and the green transition, with all its environmental benefits and economic costs involved in the decision-making process.

On the other hand, smooth transition to the green energy solutions has been emphasized in the study as a key area which is important in terms of energy efficiency and clean technologies integration. According to Onukwulu (2021), governments should be encouraged to focus on green technology development to curb carbon emission in large industries. Nevertheless, as observed by Mackay et al. (2025), although adoption of sustainability goals is crucial for the long-term advantages for the environment, the costs incurred for this purpose are massive and have to be shouldered by the businesses. These are the challenges that have illuminated the call for balanced policies that will sustain the transition with significant environmental advantages and value for money. Furthermore, the findings support Rentschler, Kornejew, and Bazilian's (2017) claim that it is difficult to eliminate fossil fuels subsidizers and correct the prices of energy in short-terms economically for companies and individuals. Therefore, such an approach in this study underlines the need for an all-inclusive, equitable initiative in climate policy and the green transformation that would recognize both the benefits and the risks of the transition.

7. Conclusion

The study concluded that climate policies and the green transition make a huge difference in economic growth, although the effect of green transition on the UK economy is found to be stronger than climate policies only. The evaluation showed that the green transition especially by the adoption of renewable energy and green technologies has more promise to the long-term economic development. This is because new employment opportunities, development of clean technologies markets, and establishment of sustainable industries have been created. However it pointed to the economic shocks suffered by fossil fuel reliant economies, including loss of jobs and financial insecurity, which is a challenge to the policymakers. The interplay of climate policies and green transition in promoting economic resilience brings significance to the strategic and well-planned policies

in order to reduce the adverse effects and yet maintain economic sustainability over the long-term. The green transition is stronger and in this respect, it is important to focus on UK-specific initiatives that can focus on renewable energy investments and creation of jobs in green areas.

Regarding policy implications, the research recommends that the UK government should enforce specific policies that facilitate the shift of the regions and industries that considerably depend on fossil fuels. This involves the provision of retraining schemes, financial schemes and business assistance to those that embrace sustainable practices. A distinction must be created between the immediate issues, e.g., employment displacement and increased energy prices, and the gain in the long run, e.g. economic diversification and weather resistance. Moreover, the policymakers ought to emphasize the sector-specific intervention, focusing on the energy, manufacturing and transport sectors. Additionally, the research recommends that future studies should investigate the long-term impacts of climate policies on the economic development and consider alternatives to implement a just transition, especially in those regions that are most susceptible to the economic shocks of the green transition.

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