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A Global Perspective on Renewable Energy Implementation: Commitment Requires Action

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Abstract: Meeting renewable energy targets is one of the most significant global challenges to achieving SDG 7—Ensure access to affordable, reliable, sustainable, and modern energy for all. This study focuses on the global energy transition to understand the factors that influence success or failure in achieving targets. First, the gap between the stated targets and our predictions was calculated. Next, the roles of economic, political, and environmental variables in determining this gap were analyzed. Data were collected from 63 countries from 2000 to 2022, ensuring the global representativeness and robustness of the results. Many countries may struggle to meet their renewable energy targets. Political stability, regulatory quality, and investment freedom play a remarkable role in helping countries get closer to achieving their targets. More industrialized countries with large populations face greater challenges due to high energy intensity. This paper aims to predict the propensity of countries to meet their energy targets by integrating the forecasting and analysis of the economic, political, and geographical factors that influence a green transition. The results provide new insights into how socioeconomic and geopolitical differences influence the energy transition, offering insights for more effective policies. It is argued that accelerated administrative procedures are needed to reduce investment uncertainty and improve energy systems' flexibility. In addition, involving local communities in the decision-making process is important to ensure the acceptance of RE projects. Finally, introducing energy markets that reflect the characteristics of renewable sources is recommended to facilitate a more rapid and sustainable transition.

Keywords: green economy; SDG-7; renewable energy; energy transition; net-zero; sustainable development

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1. Introduction

In today's sustainability-focused global context, countries' commitment to setting ambitious renewable energy (RE) targets is gaining momentum and posing economic challenges. Therefore, most countries have pledged to limit global warming to 1.5 °C [1,2]. Many governments set targets at the last UN Conference of the Parties (COP28), including tripling global RE by 2030. However, opportunity, political, economic, and geographical factors influence following up on promises, especially in the absence of multilateral support, penalties, and rewarding mechanisms [3,4] to boost investments in RE.

Based on a global sample of countries, this study examines the propensity to achieve RE targets by 2030, in alignment with the COP28 declarations to mitigate climate change. This research contributes to the academic debate by addressing a gap in the literature concerning the socioeconomic and geopolitical implications of the energy transition. Addressing this gap is crucial for increasing the chances of meeting RE targets with positive outcomes for the environment and the global economy while aiding in the fight against climate change.

Scholars are analyzing free riding in environmental agreements, which poses significant challenges to achieving common goals, noting that free riding can diminish the credibility and effectiveness of such initiatives [5], especially in the case of non-enforceable international environmental agreements [6]. Economic factors further complicate agreement dynamics; thus, addressing free-riding is critical to the success of environmental agreements [7].

Considering global pledges and joint declarations, studying countries' credibility in meeting climate promises has become a prominent topic nowadays [8,9]. Previous literature highlights significant progress toward sustainability goals and targets, underscoring the importance of national policies and investments for RE expansion [10], which correlate positively with externalities and do not hinder economic growth [11]. However, gaps remain, including technological and geopolitical disparities between countries [12], paving the way for filling research gaps on the impact of specific policies on short- and medium-term sustainability goals.

This study addresses two research questions (RQs) to evaluate the gap between countries' expected outcomes and declared targets. The first question examines whether countries are on track to meet their 2030 targets. The second investigates whether common factors, such as political, economic, and geographical elements, affect the distance from these targets. The third question explores the main determinants of the likelihood of achieving the declared targets. The results offer valuable insights that can guide future policy decisions and strategic interventions in sustainable energy transition.

The research method involved two main steps. First, we computed the gap between the declared targets and our predictions using the autoregressive moving average forecasting technique (ARIMA) [13] to project the RE share up to 2030 and compare the predicted value with the target values. Following this step, which equipped us with a gap proxy, the role of economic, political, and environmental variables in explaining the gap was analyzed. The second phase of the analysis was performed using a panel data modeling approach. The sample was representative to provide reliable insights and policy advice. This approach provides a comprehensive view of countries' propensity to meet their energy targets and, therefore, their path to SDG 7, which aims to provide energy to all efficiently from both environmental and economic perspectives.

The added value of this paper lies in its approach, which integrates an analysis of economic, policy, and morphological factors that affect the achievement of RE targets. This study evaluates these targets' technical and economic feasibility while examining how differences between countries influence the output of their policies. This approach addresses the gap in understanding the implications of transitioning to RE in various geopolitical and socioeconomic contexts.

The remainder of this paper is organized as follows: Section 2 reviews the existing literature and identifies gaps. Section 3 covers data management, variables, and research methods, including research questions and modeling approaches. Section 4 presents the results discussed in Section 5, which also discusses policy implications; concluding remarks follow.

2. Policy Background and Literature Review

Globally, increasing attention has been given to reducing greenhouse gas (GHG) emissions by expanding domestic RE generation. Despite significant disparities in RE adoption rates across countries, many countries have prioritized RE as a key strategy [14]. Geopolitical factors have primarily influenced the energy mix [15,16], along with a global commitment to increasing the RE share in electricity generation.

Recent research has focused on predicting the timing and extent of the energy transition, recognizing the rapid growth in energy demand and fuel prices that necessitate controlling GHG emissions and leading to the increased exploitation of RE [17,18]. Commissioning time is a critical factor in the development of RE projects, and according to a recent study, commissioning times for RE projects have increased significantly over the past two decades [19].

This trend is noteworthy, given that numerous governments have outlined policy frameworks for decarbonization [20,21]. These frameworks are mechanisms to harmonize and limit policy conflicts, avoid future inefficiencies, and align with objective targets [22]. In a pivotal moment for the global energy transition, countries at COP28 committed to tripling renewable power and doubling energy efficiency by 2030. Consequently, there is growing interest in evaluating global progress toward this goal, considering the economic factors involved in achieving carbon neutrality [23] and addressing other challenges related to the climate crisis [24].

As previous studies have confirmed, national policies are crucial in facilitating this transition [25]. For instance, China has leveraged policy-driven initiatives to transform its energy landscape [26]. Regarding Africa, studies on Algeria's energy transition efforts have found that hydrogen offers significant potential for the transition while providing economic benefits [27]. Focusing on the Middle East, another study discussed the social, political, and economic factors influencing each country's ability to harness RE, suggesting that the UAE and SA could benefit significantly from these implementations [28].

By 2030, the European Union intends to achieve 32% of its total energy consumption from renewable sources [29,30]. A recent study analyzed Germany's energy and climate plans, highlighting the need to accelerate efforts to meet their targets [31]. It is no wonder that Italy's path is also challenging, given its complex institutional framework [32]. It is evident, however, that the transition to a green economy requires significant investments [33].

In these scenarios, the drive toward RE is influenced by geopolitical positioning, economic opportunities, environmental concerns, and energy security. RE is a widely recognized crucial strategy for developing sustainable energy systems. The primary benefits of this strategy include encouraging significant investments, fostering industrialization and public engagement, and reducing carbon emissions. Since countries with fewer investment barriers tend to experience a faster deployment of RE technologies [34,35]; creating an environment that supports investment freedom can enhance RE development and contribute to achieving sustainable energy goals. In this context, it is also worth noting that RE significantly reduces both GHG emissions and, arguably, energy poverty [36]. Interestingly, the relationship between public participation and RE development is complex, and the role of political stability, good regulations, and the rule of law are crucial in shaping investments [37]. In general, a link between participation in political decisions and RE development is expected. Participation in decision-making processes, including those related to energy policies, can have positive implications for developing renewable energy. Countries that favor public participation are more likely to adopt progressive energy policies driven by public demand and international commitments [38]. The interaction between industrial energy demand and RE development is key to achieving sustainable development goals, driving global economic transitions, and fostering industrialization [39,40].

Countries worldwide are taking steps to increase the role of RE in their energy mix in order to align with COP28 statements and meet global climate neutrality goals [41]. However, there is a notable gap in the understanding and quantification of the diverse effects of RE adoption across different geopolitical and socioeconomic contexts. Although extensive data exist on the technical and economic aspects of RE sources, there is an insufficient focus on how these sources align with national energy targets for sustainable development. Additionally, there is a need for a more detailed analysis of policy frameworks, drivers of RE adoption, and global variations in these factors. We agree on the importance of the social and cultural implications of transitioning to RE, such as public acceptance, employment patterns, and impacts on local communities [42,43].

According to a recent study, economic, environmental, and social factors are key drivers of RE [44], along with the implementation of policies that also play a crucial role [45]. The policy promoted at COP28 enhanced our analysis by clustering countries on the basis of their distance from the stated targets to test pledges.

3. Methods

This section describes our research approach. To this extent, Figure 1 summarizes the framework of this study.

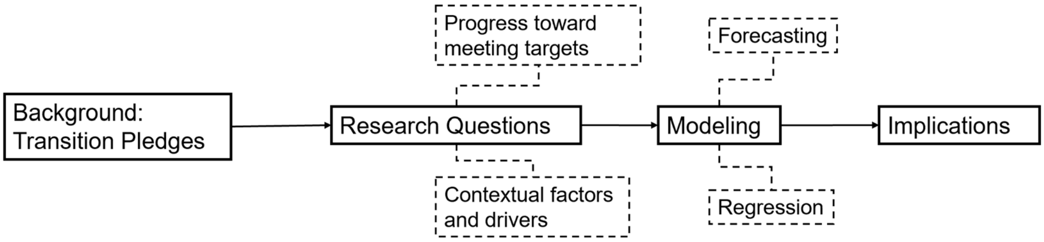

Figure 1. Research framework. Source: the authors.

3.1. Data and Variables

The data sources for this study are listed in Table 1 under the "Source" column. Specifically, the World Bank database provides information on a wide range of global topics, the EIU publishes a well-known democracy index, the Heritage Foundation is developing an economic freedom index that includes investment data, and the European Commission's Joint Research Center offers data on global carbon emissions by country. EMBER data offer detailed insights into countries' RE targets. Table 1 lists the basic variables used in this research.

Table 1. Variable description.

Variable	Description	Source
IND	Industry added value—percentage of GDP	World Bank
DEM	EIU Democracy Index (×10)	Economist Intelligence Unit [(a)]
INV	Investment freedom (i)	Heritage Foundation [(b)]
GDP	Log (GDP current USD/population)	World Bank
SKM	Squared kilometers	World Bank
POP	Log (population)	World Bank
URB	Urbanization—percentage of population	World Bank
GHG	Per capita carbon emissions	European Commission [(c)]
RES	RE percentage of electricity generation	Ember [(d)]
RAN	RE percentage of electricity generation (year) = 2000	Ember

Source: the authors. [(a)] Economist Intelligence Unit, Democracy index, 2023. [(b)] The Index of Economic Freedom published by the Heritage Foundation aims to measure the impact of liberty and free markets worldwide. [(c)] EDGAR is the Emissions Database for Global Atmospheric Research. [(d)] Ember, world electricity generation by source.

Additional metrics were computed for modeling. DTT represents the distance to the 2030 target set by countries, and it is calculated using the formula $DTT_{it} = RE_{i2030} - RE_{it}$. From our forecasting model, we also calculated DTFT, which is similar to DTT but is based on the predicted 2030 RE level, rather than commitment. RANK controls for the marginal cost of adding RE and capturing the RE level at the beginning of the observation period. The sample was selected based on the availability of data on the 2030 targets.

Four wider regions cluster the list of countries included in Table 2.

Table 2. Sample by region.

Africa and ME	America and A	Asia	Europe
DZA, EGY, ISR, KEN, NGA, SAU, ZAF, ARE	ARG, AUS, BRA, CAN, CHL, CRI, MEX, USA	BGD, CHN, GEO, IND, IDN, JPN, MYS, PHL, SGP, KOR, THA, UZB, VNM	ALB, AUS, BEL, BGR, HRV, CYP, CZE, DNK, EST, FIN, FRA, GER, GRC, HUN, ISL, ITA, XKX, LVA, MDA, MNE, NLD, MKD, NOR, POL, PRT, ROU, SRB, SVK, SVN, ESP, SWE, CHE, TUR, GBR

Source: the authors.

Based on the geographical coverage shown in Figure 2, the data could also be aggregated by region to provide region-wide insights.

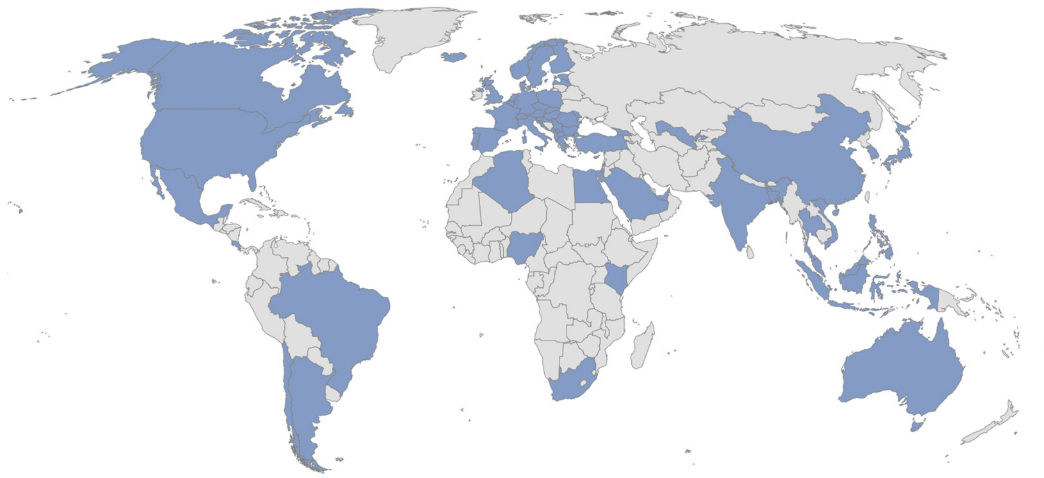

Figure 2. Spatial distribution of countries included in the sample. Source: the authors.

Table 3 reports the summary statistics of the variables described in Table 1. Note that per capita GDP data are reported in USD, whereas population units are millions of people.

Table 3. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
IND	1433	27.260	8.537	9.985	66.502
DEM	1421	6.900	1.926	1.710	9.930
INV	1417	62.862	18.850	0.000	90.000
GDP	1436	21397	20690	384	108,729
SKM	1352	12.327	1.902	6.507	16.055
POP	1444	83.872	229.541	0.281	14,171
URB	1421	67.721	18.044	19.892	100.000
GHG	1375	9.220	6.099	1.192	42.752
RES	1439	30.068	28.611	0	100
RAN	1439	31.792	18.079	1.000	63.000

Source: the authors.

Similarly, Table 4 presents the correlations among the key variables used in the regression models, supporting the hypothesis that there are no collinearity issues among the variables.

Table 4. Correlations among variables used in the regression analysis.

	IND	DEM	INV	GDP	SKM	POP	URB	GHG	RAN
IND	1								
DEM	−0.506	1							
INV	−0.450	0.669	1						
GDP	−0.303	0.523	0.608	1					
SKM	0.308	−0.165	−0.366	−0.608	1				
POP	0.298	−0.283	−0.395	−0.862	0.728	1			
URB	−0.123	0.464	0.515	0.608	−0.093	−0.263	1		
GHG	0.232	0.168	0.192	0.442	0.107	−0.172	0.559	1	
RAN	−0.301	0.279	0.151	0.123	0.086	−0.170	−0.099	−0.273	1

Source: the authors.

3.2. Research Questions

The following RQs and hypotheses (Hs) were posed to analyze the gap between actual outcomes and declared commitments. RQ1: Are countries on track to meet their targets? Ho: there is no significant difference between our predictions and the commitments made by countries, implying that predicted values closely match the targets set by nations and suggesting high attainment. Conversely, H1 suggests a significant difference between predicted RE levels and declared commitments, indicating potential challenges or discrepancies in achieving the stated goals. Testing these hypotheses will provide insights into the effectiveness and feasibility of RE commitments for 2030. We identified several political, economic, and geographical factors and analyzed their correlation with the distance from each country's targets. RQ2: What are the key determinants of meeting declared targets? Ho: socioeconomic variables influence the probability of meeting the goals, whereas H1 posits that the path to meeting targets is randomly distributed worldwide.

3.3. Modeling

As mentioned, the empirical analysis was based on two consequential phases: the forecasting approach and panel data analysis. The RE share in 2030 was predicted using ARIMA forecasting modeling that combines two components: an autoregressive part of order p and a moving average part of order q. The autoregressive component can be formalized as follows:

$$x_t = c + \sum_{i=1}^{p} \phi_i x_{t-i} + \epsilon_t \tag{1}$$

In Equation (1), x_t is the stationary variable, c is the constant, ϕ_i are autocorrelation coefficients at lags 1, 2, . . ., and p and ϵ_t are the residuals. The moving average can then be written in the form of Equation (2):

$$x_t = \mu + \sum_{i=0}^{q} \theta_i \epsilon_{t-i} \tag{2}$$

where μ represents the expectation of x_t, which is usually assumed to equal zero, θ_i are the weights applied to the current and prior values of a stochastic term in the time series, and $\theta_0 = 1$. Combining Equations (1) and (2) results in an ARIMA model, as shown in Equation (3).

$$x_t = c + \sum_{i=1}^{p} \phi_i x_{t-i} + \epsilon_t + \sum_{i=0}^{q} \theta_i \epsilon_{t-i} \tag{3}$$

Applying a prediction method is crucial for examining future changes in countries' commitment to and implementation of targets [46]. Previous research has identified various determinants and characteristics that influence RE development, particularly in response to the increasing demand for renewable energy. The predicted value is used to compute the gap in the upper bound of the 95% confidence interval. Consequently, the gap between the declared target and predicted value is calculated as shown in Equation (4).

$$DTT_{i2030} = target_{i2030} - forecast_{2030i} \tag{4}$$

This difference indicates how far short of or above the predicted value is compared to the target, leading us to classify countries into three categories, CL, as (i) strivers, (ii) movers, and (iii) leaders, according to the probability of meeting the targets, based on Equation (5):

$$\text{CL} = \begin{cases} \text{Leaders}: & DTT \leq -\delta \\ \text{Movers}: & -\delta < DTT \leq \delta \\ \text{Strivers}: & DTT > \delta \end{cases} \tag{5}$$

This method represents each country's status relative to its RE target. We adopted a precautionary approach that prepares decision-makers for scenarios in which RE adoption may exceed expectations, necessitating more robust planning and resource allocation strategies to meet potentially higher demand. The lower limit provides a conservative estimate, whereas the upper limit represents an optimistic scenario in which conditions favor RE expansion. It is important to acknowledge that this approach has limitations; indeed, ARIMA models are often sensitive to parameter selection and are primarily suited for short-term forecasting, whereas medium- to long-term forecasting may lead to inaccurate conclusions.

After that, a second phase was set, and panel data regression was conducted to test the hypotheses. This study analyzes the relationships among economic, political, and environmental variables using regression analysis with panel data. Panel regression was chosen because it combines time series data and cross-sectional data, allowing for the simultaneous consideration of variations over time and between units. This approach captures specific effects that may not be observable through time series or cross-sectional analysis alone. A panel data regression model can be represented as shown in Equation (6):

$$Y_{it} = \alpha + \beta X_{it} + \mu_i + \epsilon_{it} \tag{6}$$

where: Y_{it} is the dependent variable for unity i in t, X_{it} is the vector of independent variables, α is the intercept, β is the vector of the coefficients of the independent variables, μ_i captures unit-specific effects, and ϵ_{it} is the error term. A panel data model was used to analyze the data: starting from 63 countries from 2000 to 2022, three countries were excluded from the models due to a lack of data. The variables considered include economic, political, and environmental indicators. Our regression equation is formalized in Equation (7).

$$\begin{aligned} DTT_{it} = \alpha + \beta_1 IND_{it} + \beta_2 DEM_{it} + \beta_3 INV_{it} + \beta_4 GDP_{it} + \beta_5 SKM_{it} \\ + \beta_6 POP_{it} + \beta_7 URB_{it} + \beta_8 GHG_{it} + \mu_i + \epsilon_{it} \end{aligned} \tag{7}$$

This setup allowed us to identify the effect of each independent variable on the dependent variable by considering the specific characteristics of each state and variations over time. The Hausman test was used to determine whether fixed- or random-effects models were used. Since χ^2 = 36.39 and p = 0.000, the fixed-effects model was consistent, and it was used to conduct the analyses.

4. Results

Figure 3 outlines the share of RE in electricity generation, RE targets, and the distance to the target in various regions: Africa and the Middle East, the Americas and Australia, Asia, and Europe. Figure 3A shows the probability of reaching RE targets based on Equation (5). The total average values across all categories indicate varying levels of progress and commitment between regions. Striving regions are significantly dependent on fossil fuels. The gap between these regions is 32.14%, reflecting the remarkable need to accelerate the transition. Their target is set to 45.93%, which is ambitious compared to their current RE. In regions with an average probability, the RE is 21.64%, and the gap is 34.32%, indicating that considerable effort is needed to achieve the 2030 target of 56.07%. Leading regions have already achieved 45.97% of RE adoption, indicating strong current performance in RE adoption. Their gap is 18.49%, indicating a smaller gap to fill to meet the 2030 targets, which are set to 64.46%. These regions are promising for reaching their RE goals.

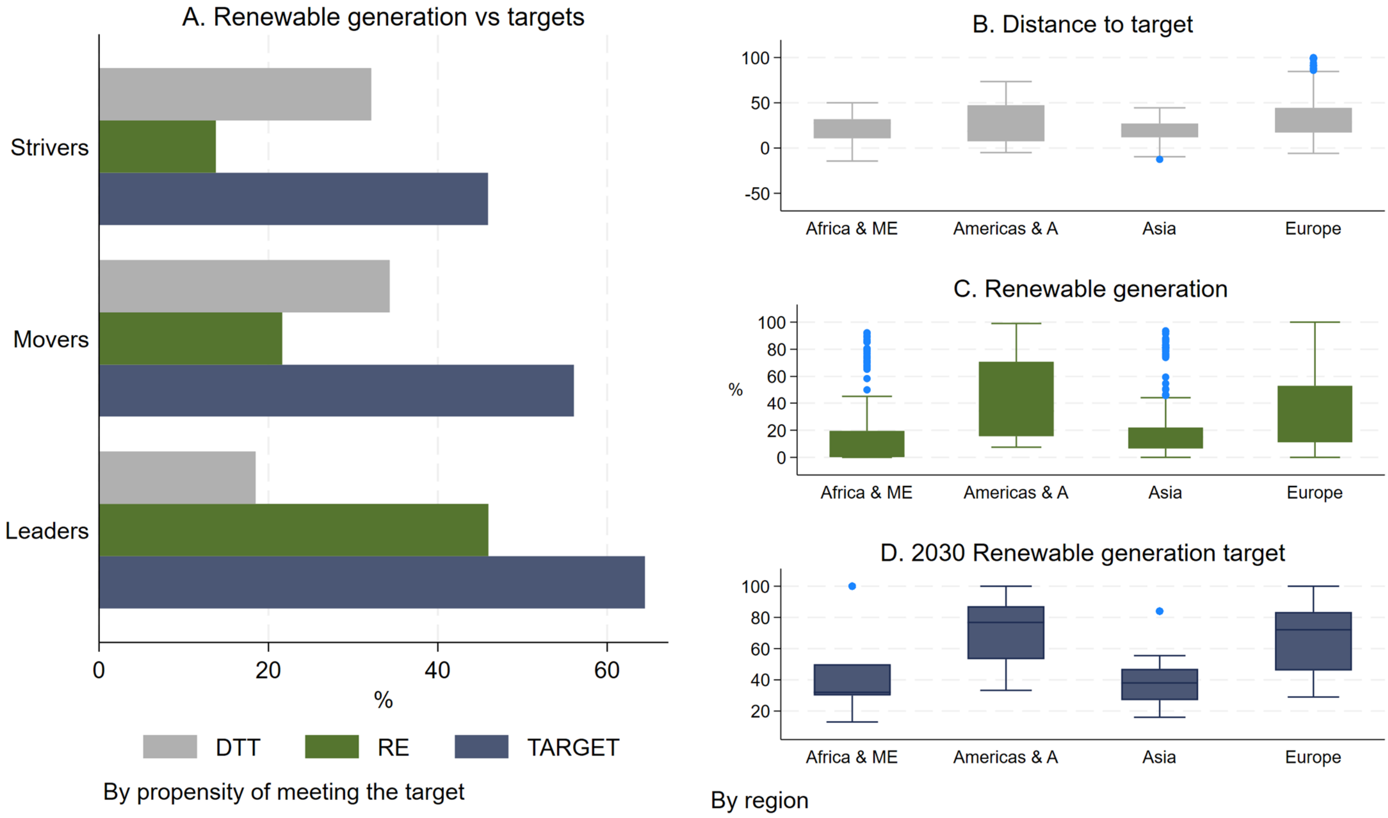

Figure 3. Commitment, observed values, and distance to targets. Source: the authors. (**A**) presents the RE share, the 2030 targets, and the gap based on the clusters derived from our analysis. Panels (**B**–**D**) provide a geographical breakdown of the variables.

The DTT in Figure 3B highlights the progress needed for each region to meet its commitments. Africa, the Middle East, and Asia have DTT values of 24.13% and 19.61%, respectively, indicating a smaller gap to bridge compared to Europe (32.53%) and the Americas (26.55%) However, Asia and Africa have set less ambitious targets than Europe and the Americas, partly because of their lower current share of RE. Europe and the Americas will require significant efforts to reach their ambitious 2030 targets. The 28.02% gap, on average, underscores the region's overall challenge in scaling up RE to meet its targets. Figure 3C presents the observed percentage of electricity generated from renewable sources. The Americas led with 44.42% of RE, followed by Europe with 34.03%. Other regions have lower values: 15.43% in Africa and the Middle East and 19.87% in Asia. The total average across all regions was 30.07%. The targets reported in Figure 3D represent the RE shared by each region. The US has an ambitious target (70.96% on average), indicating a strong commitment to increasing RE. Europe follows (an average target of 66.59%), whereas, on average, Africa and the Middle East have an established target of 39.56%, versus Asia's 39.48%. The total average target is 58.15%. Figure 4 illustrates the evolution from 2020 to 2021—the final year—with available information for all countries on three variables: investment freedom, the RE share in electricity production, and the distance to the target.

Figure 4 shows that freedom of investment has a significant positive correlation with RE, indicating that greater investment freedom is associated with a larger share of RE in electricity production. Freedom of investment also has a moderate positive correlation with the gap. Although RE positively correlates with the gap (0.2742), the association between the current share of RE and the distance to the 2030 target is relatively weak. This suggests that regions with higher RE shares still need to make substantial progress to meet their future targets. Public participation in decision-making is highly positively correlated with RES (0.8818) and INV (0.8218). RE is consistently correlated with people's involvement in decision-making (0.8818). However, democracies tend to show a greater gap, even when it is moderate. Indeed, some democratic countries face difficulties in promoting renewable energy development because of vested interests in fossil fuels or other challenges. Similarly, other countries have made significant progress in renewable energy, often through centralized decisions that bypass public consensus. Switching to the second phase, Table 5 presents the results obtained from the model formalized in Equation (7). More industrialized, democratic, and populous countries generally face greater challenges in achieving these goals. Conversely, countries with greater investment freedom, higher GDP per capita, larger land areas, and greater urbanization are better positioned to advance toward their targets.

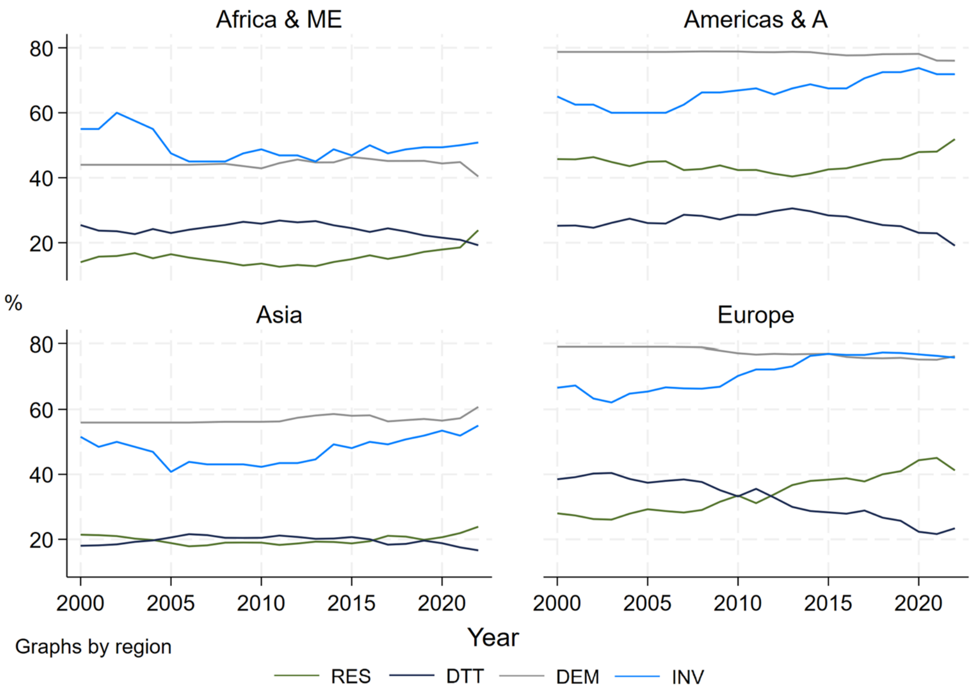

Figure 4. Renewable energy development and political setting. Source: the authors. The figure shows the evolution of prominent socioeconomic variables (labeled in Table 1), along with energy variables.

The role of industrialization in RE deployment has been discussed with similar results [47]; in this regard, energy efficiency incentives and tools are expected to play a central role [48]. Our results indicate that industrialized countries tend to move farther from the target due to higher energy intensity. This can be explained by the fact that industrialized economies are more energy-intensive and require significant investments in order to transition to RE. Given that the literature suggests that countries that promote public participation are expected to invest more in RE [49], countries with higher public engagement tend to set more ambitious goals, likely because democratic governments are more responsive to environmental and voter pressures, leading them to establish higher targets, which may contribute to a greater distance from achieving these objectives. Given the mixed results of economic freedom on the sustainability level [50], investment freedom is associated with a reduced gap. This suggests that countries where financing new plants is easier can make faster progress toward these goals. Consistent with the link between GDP, carbon emissions, and RE [51], GDP per capita suggests that countries with higher GDP per capita tend to be closer to RE goals. Richer economies may have more resources to invest in green technologies and sustainable energy infrastructure. Land area indicates that countries with larger land areas are closer to their RE targets. One possible explanation is that these countries have more space to install RE plants, such as wind and solar farms. Nevertheless, the interaction between GDP and industrialization confirms that more industrialized countries may meet demand with RE alone by 20230. The population suggests that countries with larger populations tend to be farther from their targets. A larger population leads to higher energy consumption, making it more challenging to meet RE goals. The degree of urbanization suggests that greater urbanization is associated with a smaller gap; notably, previous studies have reported a relationship between urbanization and carbon emissions [52]. Urbanization can facilitate efficient energy use because of the concentration of infrastructure and resources. The coefficient of per capita carbon emissions indicates that countries with higher per capita emissions are farther from their RE targets, reflecting a greater dependence on fossil fuels.

Table 5. Regression output.

Variable	(1)	(2)
IND	0.264 *** (−0.064)	0.0780 * (−0.0465)
DEM	4.669 *** (−0.647)	3.946 *** (−0.466)
INV	−0.0852 *** (−0.019)	−0.0813 *** (−0.0133)
GDP	−1.349 *** (−0.489)	−1.505 *** (−0.352)
SKM	−107.1 ** (−46.75)	−41.49 (−33.67)
POP	19.95 *** (−2.221)	−0.479 (−1.705)
URB	−0.558 *** (−0.074)	−0.481 *** (−0.0529)
GHG	2.630 *** (−0.132)	1.094 *** (−0.105)
RANK		−0.973 *** (0.0284)
Constant	987.0 * −574.9	568.1 −413.5
Observations	1317	317
R-squared	0.379	0.679
Number of ISOs	60	60

Source: the authors. (1) refers to the main model described in Equation (7), while (2) includes the same model with an additional variable to control the starting point. The added variable represents the level of renewable energy in the first year of the analysis. Standard errors are in parenthesis. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Discussion and Policy Implications

By focusing on the impact of economic, political, and environmental variables on RE adoption and the achievement of declared targets, this study provides global insights into the prominent challenges of the energy transition. If countries with a greener energy mix are expected to meet the targets, and in contrast, those that rely on fossil fuels face a substantial gap, policies play crucial roles in boosting convergence.

This study shares some similarities with similar studies. For example, a recent study suggests that economic disparities are significantly impacted by a country's pursuit of a greener energy mix [53]. Countries with more economic resources and more political stability tend to outperform in their efforts [54]. Additionally, achieving RE objectives is linked to technological innovation, political stability, and public participation in decision-making [55] as drivers. Our analysis also shows that well-designed policies can significantly improve outcomes, which is consistent with previous insights [56]. National policies and investments affect the likelihood of success in RE, making supportive policies and financial incentives crucial for accelerating the transition.

The results provide interesting answers to these questions. Considering RQ1, many countries may struggle to meet their RE targets. For RQ2, it is confirmed that political, economic, and geographic factors significantly correlate with this distance. Countries with greater political stability, regulatory quality, economic freedom, and urbanization tend to more closely meet their RE goals.

This study has some policy implications to support the transition toward a greener economy. As argued, acceleration is needed to get back on track and maintain commitments, and many economies will need to implement more renewable capacity than planned; however, many barriers remain, as underscored by the International Energy Agency. Consistently, some policy implications are provided:

- Permitting time: it is important to simplify rules and administrative procedures in order to reduce investment uncertainty;
- Engagement: placing local communities at the center of the decision-making process;
- Acceptability: providing information on the benefits and costs of additional RE capacity so that projects are understood;
- Infrastructure: investing in a long-term planning network;
- Flexibility technologies: improving system flexibility to integrate variable RE costs effectively;
- Financing: designing energy markets consistent with long-term climate strategies to overcome high project costs;
- Smart grid: introducing incentives and investing in capacity and grid capillarity;
- Market design: upgrading or setting energy markets based on RE characteristics and technologies.

While these policies are broadly applicable, the first four are particularly critical for countries needing to expand their RE share. All the policies mentioned share a common feature: the need for trained personnel, which is critical for engaging local communities. In addition to perceiving the burdens, such as land use and visual impacts, residents can also appreciate the benefits. Therefore, working on human resource development is important for a greener economy and economic growth. Policies should include economic incentives, support for research and development, and regulatory mechanisms that promote sustainability. Understanding the factors that influence RE adoption can guide investments and business strategies that maximize environmental and economic benefits.

To this extent, consistent with the need to rethink how energy markets work [57], operating rules, and infrastructure settings, Figure 5 resumes some prominent drivers expected to accelerate the transition toward cleaner economies.

The drivers in Figure 5 are clustered according to three levels from a macro-political perspective to the micro level with actionable policy and economic implications. Leading countries exhibit strong political commitment and a supportive regulatory environment that fosters the adoption of renewable technologies. In this regard, governance is important as the role of effective system operators [58] in the design, implementation, and healthy functioning of energy markets. The mentioned policies can concur in accommodating the global transition and other political issues [12,59].

This study was not exempt from limitations. As mentioned, the model is sensitive to parameter selection, and it is better suited to short-term forecasting. Thus, integrating machine learning or Monte Carlo simulations could guide future analyses by better capturing potential long-term shifts. Uncertainties in data and changes in future policies could impact the accuracy of our forecasts. Moreover, classifying regions based on forecasts may not fully capture local dynamics and specific socioeconomic factors. Finally, due to incomplete or non-accessible data, the regression model did not take into consideration prominent factors such as the cost competitiveness of different technologies and the production capacity across the surveyed countries. Nevertheless, the methodological approach can be applied to other areas and sectors in order to evaluate and enhance sustainability policies.

These limitations suggest further research to refine models and include a broader range of variables and scenarios.

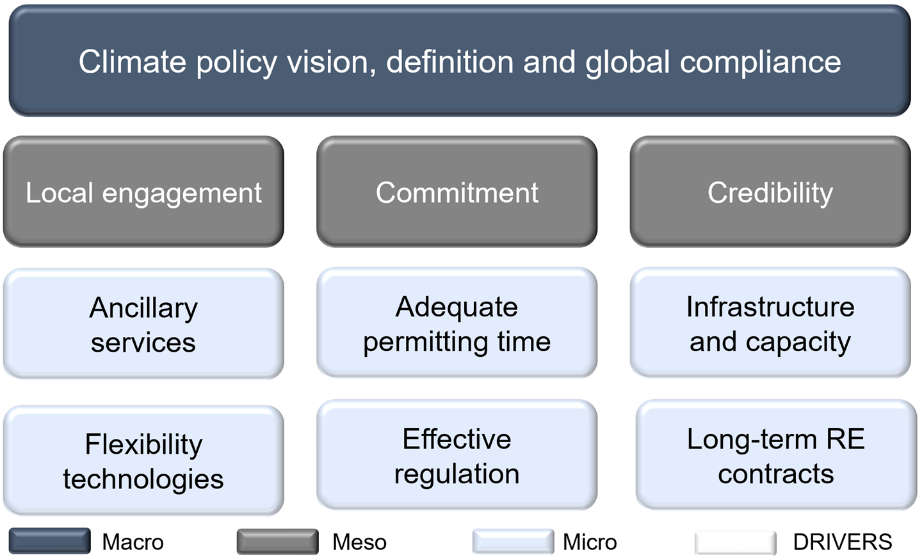

Figure 5. Transition accelerating drivers. Source: the authors. This figure presents three levels of drivers for the transition to cleaner energy. It serves as a framework for policymaking.

6. Conclusions

This study has analyzed countries' ability to meet RE targets in line with their commitments, highlighting the importance of political, economic, and geographic factors that impact RE development. The results show significant discrepancies between predicted and stated targets, suggesting that many countries may face difficulties achieving these targets. Public participation, regulatory quality, and economic freedom are crucial to successful RE investments. This study advances the literature by focusing on the interaction between socioeconomic and geopolitical variables and RE growth, particularly in relation to the targets that countries have pledged to meet. More coherent policies and targeted economic incentives are needed to accelerate the transition to a greener economy. This study emphasizes the need to simplify administrative procedures, improve energy systems' flexibility, and promote local communities' participation in decision making. A path emerges from the recommendations: legal engagement is important to create conditions, commitment is necessary to define economic and energy strategies, and credibility is crucial to stimulate further investment. The recommendations apply to latecomer countries needing to expand their RE share and leading countries to improve the efficiency of energy markets.

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