
Asian Journal of Law and Policy

Vol. 6 No. 2 (July 2026)

eISSN: 2785-8979

Law, Energy, and the Environment: How Rule of Law Conditions the Carbon Impact of Energy Consumption in Developing Economies

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ABSTRACT

This study is inspired by the fact that carbon dioxide emissions have continued to increase in the developing world and the increased realisation that legal frameworks do influence the environment. Though dependency on fossil fuels has been recognised as one of the key contributors to carbon dioxide emissions, little focus has been given to the role played by the rule of law in conditioning the environmental impacts of the consumption of fossil fuels as well as renewable energy. This study aims to investigate the direct consequences of energy use in fossil fuels and renewable energy use on carbon dioxide emissions, and determining whether and how the rule of law moderates these associations. Using panel data from thirty-seven developing economies spanning the years 2015 to 2023, the study applies panel regression techniques to estimate the effects of fossil fuel consumption, renewable energy consumption, and the rule of law on carbon dioxide emissions. The baseline findings show



® (2026) Asian Journal of Law and Policy, 6(2), 349–366

<https://doi.org/10.33093/ajlp.2026.17>

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Published by MMU Press. URL: <https://journals.mmuupress.com/ajlp>



that fossil fuel consumption significantly increases carbon dioxide emissions, while renewable energy consumption has a positive but statistically insignificant effect. However, once interacting with the rule of law, fossil fuel consumption becomes negatively and significantly associated with carbon dioxide emissions, indicating that stronger adherence to the rule of law can mitigate its environmental impact. The study offers a novel legal perspective by demonstrating that the rule of law conditions the carbon consequences of energy consumption. It contributes to the advancement of Sustainable Development Goals 7, 13, and 16 by emphasising law as a critical instrument for sustainable energy transitions and climate governance.

Keywords: Rule of law; Carbon dioxide; Fossil fuel energy; Renewable energy; Sustainable development goals

Received: 20 February 2026, **Accepted:** 29 April 2026, **Published:** 31 July 2026

1. Introduction

The escalating frequency of extreme weather events and the deterioration of global ecosystems have placed climate governance at the forefront of the international agenda (Catanzaro & Jeffords, 2026). Despite the adoption of the Paris Agreement and a global surge in net-zero pledges, atmospheric carbon dioxide levels continue to reach record concentrations, with energy-related emissions rising to over 36.8 Gt in 2022 (Andabayeva et al., 2025). This environmental crisis disproportionately burdens developing countries, which face the ‘bitter-sweet’ challenge of sustaining rapid economic growth while navigating the imperatives of environmental sustainability and climate action (Doan et al., 2025).

Although fossil fuel dependency is still considered to be a key source of carbon emissions among the underdeveloped countries, it seems that the causal effect of energy consumption on environmental impacts has shifted from being technical to becoming institutionally determined (Borozan & Borozan, 2025; Massonini Ngoma et al., 2024). From this standpoint, the role of the rule of law is of critical importance since legal institutions determine the ability to regulate the level of emissions, their enforcement, as well as the necessary conditions for investment in sustainable energy (Behera et al., 2025; Borozan and Borozan, 2025; Wu and Bianchi, 2026). Despite its theoretical significance, existing studies do not produce a consistent picture concerning whether better quality institutions lead to better environmental results. The latter implies that the effects of the rule of law are not deterministic but conditional, meaning that they depend on how energy consumption is transformed into emissions (Borozan & Borozan, 2025; Otim & Mutumba, 2025).

Although the world strives towards a shift to sustainable energy, the need to deal with the issue of carbon emissions has never been more urgent. The International Energy Agency (IEA) reports in 2024 in the Global Energy Review that the world’s emissions of carbon dioxide in energy-related activities have reached an unprecedented peak of 37.8 billion tonnes of the gas in 2024, with a 2.2 per cent growth in the global demand for energy (International Energy Agency, 2025). There is a strong trend that has been driven by a long-

standing dependence on fossil fuels, especially natural gas and coal, which contributed towards a large percentage of growth in the emerging and developing economies. The Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report emphasises that human influence has unequivocally warmed the atmosphere, with unsustainable energy use being a primary driver of the 1.1°C temperature rise observed since the pre-industrial era (Intergovernmental Panel on Climate Change, 2023). Compounding these environmental challenges is the ongoing deterioration of institutional frameworks. According to the report by the World Justice Project (WJP) Rule of Law Index 2024, the rule of law in 57 out of the 100 surveyed countries has been on the downslope in the past seven years (World Justice Project, 2024). The resulting loosening of regulatory oversight and governmental responsibility creates a so-called gap in governance, which may impede the realisation of climate policies and the reduction of the effects of fossil fuels in the developing countries. Furthermore, as illustrated in Figure 1, the tendencies in the developing countries are highly uneven: some of them show a negative tendency of decreasing carbon dioxide emissions, whereas other countries indicate the persistent upward tendency. A similar deviation can also be noted in the area of the rule of law, where there are certain developing countries which are showing an obvious decline in their countries, and others which are showing a progressive institutional strengthening during the same measure. As a result, the question of how the rule of law preconditions the connection between energy use and environmental quality is not only an issue of theory anymore but also a subject of practical importance to the global climate regulation.

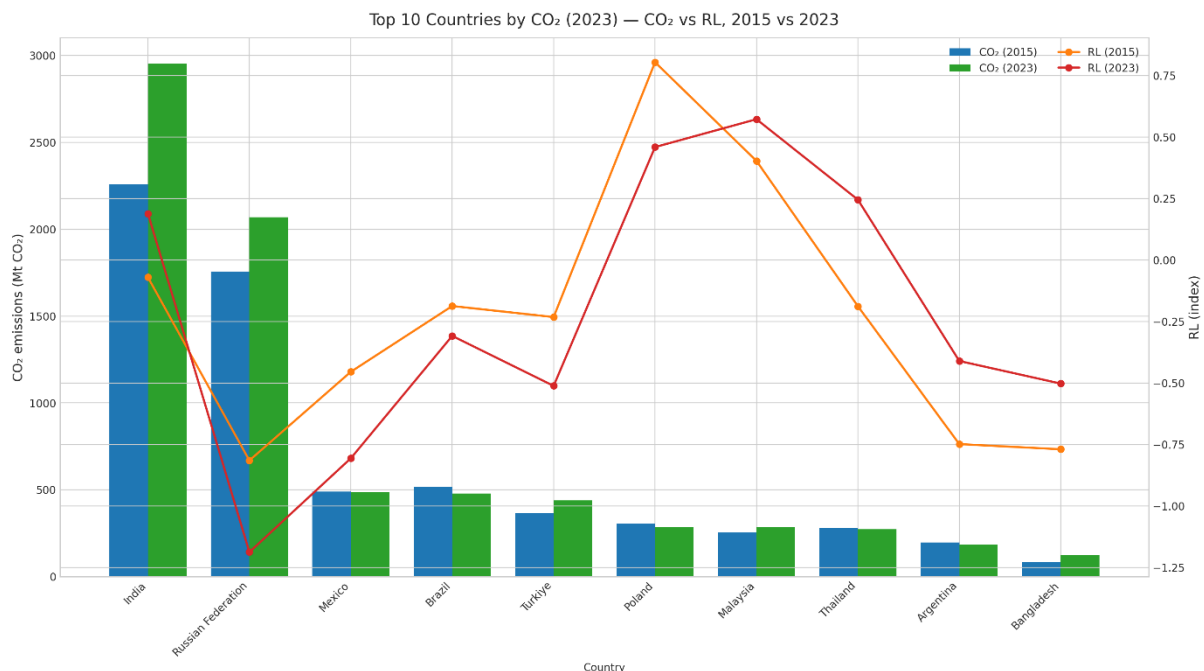


Figure 1: The trends in the rule of law (RL) and carbon dioxide emissions (CO₂) in selected developing countries between 2015 and 2023

This study aims to address these critical gaps by examining how the rule of law conditions the carbon impact of energy consumption in thirty-seven developing economies from 2015 to 2023. We contribute to the literature by moving beyond the direct effects of energy types and institutional quality to test a conditional hypothesis: that the environmental consequences of fossil fuel and renewable energy consumption are moderated by the strength of a country's legal framework (Ehigiamusoe & Lee, 2026). Our findings demonstrate that while fossil fuel consumption is an unconditional driver of emissions, a strong rule of law acts as a critical instrument for mitigating its impact and facilitating sustainable energy transitions. In doing so, this research offers a novel legal perspective on climate governance, directly advancing Sustainable Development Goals (SDGs) 7 (Affordable and Clean Energy), 13 (Climate Action), and 16 (Peace, Justice, and Strong Institutions) (Byaro & Timbuka, 2025).

This study offers several significant contributions to the literature on climate governance and energy economics. Primarily, it introduces a novel legal perspective by demonstrating how the rule of law conditions the environmental consequences of energy consumption in thirty-seven developing economies spanning 2015 to 2023. While the relationship between energy use and carbon emissions is often treated as a direct technical link, this research explores the institutional foundations of environmental performance by assessing the moderating role of legal frameworks. Methodologically, by moving beyond aggregated direct effects to examine the conditional impacts of both fossil fuel and renewable energy, this study addresses a significant gap regarding the rule of law mechanisms necessary for sustainable energy transitions. Furthermore, by providing contemporary empirical evidence that stronger adherence to the rule of law can significantly mitigate the carbon-intensive impact of fossil fuel consumption, this research provides actionable insights for achieving Sustainable Development Goals (SDGs) 7, 13, and 16. Lastly, this study highlights the rule of law not only as a formal obligation but as an important tool of strong climate governance and decouple economic development and destructive impact on the environment in the developing world.

This study contributes to the legal research area by extending beyond a composite econometric index to encompass concrete legal dimensions. In the context of environmental governance, the rule of law reflects the existence, quality, and enforcement of legal frameworks such as environmental protection statutes, emissions standards, regulatory permitting systems, and judicial mechanisms for dispute resolution. These legal institutions shape environmental outcomes in several ways. First, regulatory clarity and statutory stringency determine the scope and limits of permissible emissions. Second, enforcement capacity, including monitoring agencies and sanctioning mechanisms, ensures compliance and deters violations. Third, judicial effectiveness enables affected parties to challenge environmental harm and hold polluters accountable. Finally, legal certainty and protection of property rights facilitate long-term investments in cleaner technologies and renewable energy infrastructure.

The rest of this paper follows the following structure. Section 2 presents an analysis of the corresponding literature on energy consumption, carbon emissions, and the rule of law to define the theoretical background and posits the hypotheses of the study. Section 3 presents the sources of data, definition of variables, and the methodology and specifications of the panel regression models and interaction terms, which will determine the moderating effect of the rule of law. Section 4 provides the findings of the empirical study, which outlines the direct effects of the types of energy and the conditional effects that are brought by the institutional strength of the law. These findings are discussed in section 5, and their implications for climate governance are discussed. Lastly, Section 6 provides concluding remarks, summarising the study's contributions, offering targeted policy recommendations for developing economies striving to meet the global sustainability goal and discussing the limitations of the study.

2. Literature Review

2.1 Theoretical Background

The interaction of law, energy, and the environment is mainly based on New Institutional Economics, which implies that economic and environmental outcomes are governed by formal rules such as laws and property rights, as well as informal norms (Borozan & Borozan, 2025). The theorised development of high-quality institutions will reduce transaction costs and inhibit regulatory capture, thereby enhancing adherence to environmental standards. In contrast to this is the Ecological Modernisation Theory (EMT), which postulates that it is possible to decouple economic growth and environmental degradation via institutional reflexivity and technological innovation (Ehigiamusoe & Lee, 2026). The Environmental Kuznets Curve (EKC) also offers a model in which, initially, the rate at which the environment is harmed rises with the level of income, but at some point, there is a turning point typically marked by more powerful legal regulations and environmental stringency (Catanzaro & Jeffords, 2026). Finally, Sustainable Development Theory emphasises that the attainment of climate objectives necessitates both economic growth and the institutional capacity outlined in Sustainable Development Goal (SDG) 16 (Byaro & Timbuka, 2025).

From an environmental law perspective, legal frameworks function as the primary instruments through which states regulate emissions, manage natural resources, and enforce sustainability standards. Environmental regulation typically operates through a combination of command-and-control instruments (such as emissions limits and licensing requirements), market-based mechanisms (such as carbon pricing), and procedural tools (such as environmental impact assessments). The literature on regulatory governance also highlights that the efficacy of these tools resides in institutional capacity, transparency and accountability. In this regard, the rule of law does not just express the existence of formal regulations, but also their regularity and reliability in implementation.

2.2 Literature Review and Hypotheses Development

2.2.1 Energy Consumption and the Carbon Output

Fossil fuel energy consumption is universally identified in the sources as a fundamental determinant and primary driver of rising carbon dioxide emissions. It has become consensus that the initial phase of economic development in most countries relies on industrial development that is heavily reliant on coal, oil, and natural gas, which in turn causes the concurrent increase in emissions. From a theoretical perspective, the Environmental Kuznets Curve (EKC) explains this relationship as a 'scale effect', where increased economic activity without energy innovation necessitates a surge in demand for natural resources, exacerbating pollution (Muhammad & Long, 2021). Hence, we posit the first hypothesis as follows:

H1: Fossil fuel energy consumption has a significant positive direct effect on carbon dioxide emissions.

While fossil fuel dependence is a consistent driver, the role of renewable energy as a mitigating factor presents a more complicated pattern. Globally, transitioning to wind, solar, and hydroelectric power generally reduces the ecological footprint and hydrocarbons (H. S. Lee et al., 2025). However, what remains a point of significant contradiction is whether this transition is effective in developing economies facing high integration costs and 'grid instability'. Some studies even report that renewable energy adoption can increase emissions or hinder short-term growth due to its limited share in the total energy mix or the high upfront costs of infrastructure upgrades. Thus, we suggest the second hypothesis as follows:

H2: Renewable energy consumption has a significant direct effect on carbon dioxide emissions.

2.2.2. The Moderating Role of the Rule of Law

The rule of law is theorised as the foundational institutional dimension for environmental compliance (Kilinc-Ata et al., 2025). Grounded in New Institutional Economics, strong legal frameworks are expected to reduce transaction costs and curb the misuse of resources, thereby promoting adherence to environmental standards and securing property rights necessary for sustainable investment (Borozaan & Borozaan, 2025). In practice, the enhancement of the rule of law is often associated with a decrease in emissions in such a diverse range of settings as Saudi Arabia, countries of the Belt and Road, and OECD countries (Muhammad & Long, 2021).

Nevertheless, there is a huge institutional puzzle. A number of studies conclude that better governance indicators have a paradoxical tendency to escalate emissions. This paradox has been attributed to the scale effect, where efficient institutions bring about the stability of the economy and the investments required to support large-scale industrial work, which are carbon-intensive in the initial phases (Imam et al., 2025). Furthermore, there

is a clear research gap regarding the moderating role of the rule of law. Although the majority of research examines direct effects or evaluates aggregate indicators to explain their relationship, little evidence has been found on how the rule of law specifically moderates the effect of energy consumption (Muhammad & Long, 2021).

This research is necessary in order to resolve these tensions by evaluating whether the environmental implications of energy consumption are conditional on the legality. For fossil fuels, we argue that a strong rule of law ensures that firms comply with pollution control protocols and that environmental regulations are consistently applied, thereby mitigating the emissions typically associated with industrial activity (Muhammad & Long, 2021). For renewable energy, the rule of law provides the predictability and contract enforcement necessary to attract the large-scale, long-term investments required for a successful transition (Lobonț et al., 2025). Logical argumentation suggests that increased energy consumption only results in lower environmental pollution through the interaction effect of a robust legal system (Yaman & Cetin, 2025). Therefore, we propose the third and fourth hypotheses as follows:

H3: The rule of law significantly moderates fossil fuel energy consumption to decrease carbon dioxide emissions.

H4: The rule of law significantly moderates renewable energy consumption to decrease carbon dioxide emissions.

2.3 Research Gaps

Although a lot of research has been conducted on the cause of carbon dioxide emissions, a number of important gaps still exist. First, the direct impact of institutional quality or energy type is studied in the majority of the studies, but the moderating role of the legal frameworks, especially the rule of law, is not investigated within the conditional econometric framework (Ehigiamusoe & Lee, 2026). Second, current literature tends to use aggregate indices of governance that may hide idiosyncratic paths and effects of certain dimensions of law, such as the rule of law (Byaro & Timbuka, 2025). Third, it has not done a comparative analysis covering developing economies in the post-Paris Agreement era, which is a period characterised by changes in the global climate governance needs (Saba et al., 2025). Finally, the limited literature has evaluated the effect of the rule of law in narrow aspects of conditioning the effect of both renewable and non-renewable energies at the same time, and hence a gap in our knowledge about the institutional mechanisms that would support a successful and legally supported energy transition (Behera et al., 2025). This paper seeks to address these gaps with a view to studying thirty-seven developing economies using an interaction-based approach.

2.4 Research Framework

We refer to annual carbon dioxide emissions as a dependent variable in our model as an indicator of the quality of the environment. Fossil fuel consumption and renewable energy consumption are the main independent variables. In order to test the conditional hypothesis, we incorporate a term of interaction between the energy consumption and the rule of law, which will enable us to test the way in which the legal environment moderates the relationship between energy consumption and emissions. The model also factors in the control variables, such as gross domestic product per capita, and foreign direct (FDI) investment, to make sure that the success of isolation of the institutional impacts is strong. Figure 2 presents the research framework for this study.

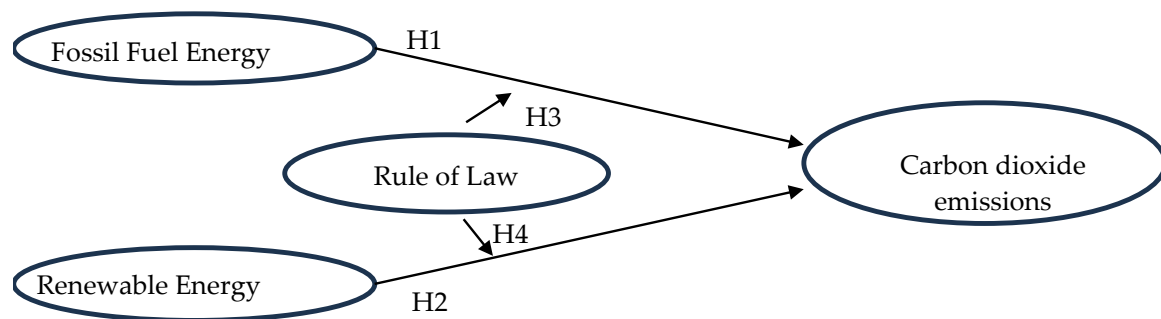


Figure 2: Research Framework

3. Data and Methodology

3.1 Data Source and Variables

In this study, the balanced panel dataset is used on thirty-seven developing economies from 2015 to 2023. It is this period that is specifically selected to portray the institutional and environmental transformation that took place after the Paris Agreement was adopted. World Bank sources are used to collect the data: the World Development Indicators (WDI) and Worldwide Governance Indicators (WGI).

The dependent variable is carbon dioxide emissions (CO₂), quantified in million tonnes, which represents environmental quality. The major independent variables are Fossil Fuel Energy Consumption (FF), which is a percentage of total energy consumption and Renewable Energy Consumption (RE), which is the share of renewable sources in total final energy consumption. Since agents are expected to trust and follow the rules set by society, the moderating variable, Rule of Law (RL), takes values between -2.5 and 2.5. The higher the score, the better the performance of the rule of law. We also use Gross Domestic Product (GDP) per capita (constant 2015 US\$) and Foreign Direct Investment (FDI) net inflows as control variables. Table 1 shows the summary of the data and variables.

Table 1: Summary of the Data and Variables

Type	Variable	Abbreviation	Source
Dependent variable	Carbon dioxide emission	CO2	WDI (https://databank.worldbank.org/source/world-development-indicators)
Independent variable	Fossil Fuel Energy Consumption	FF	
Independent variable	Renewable Energy	RE	
Control variable	Foreign Direct Investment	FDI	
Moderating variable	Rule of Law	RL	
Control variable	Gross domestic products per capita	GDPC	WGI (https://www.worldbank.org/en/publication/worldwide-governance-indicators)
Moderating variable	Rule of Law	RL	

3.2 Model specifications

In order to examine the direct impact of fossil fuel (hypothesis 1) and renewable energy (hypothesis 2) on carbon dioxide emissions, we use a panel regression model in the form of equation (1). The coefficients (β_1 and β_2) are the average change in the CO2 emission per unit of fossil fuel/renewable energy consumption by all the sample countries. The significance and positive β_1 value indicate that the consumption of fossil fuels in this particular model is an unconditional driver of emissions, i.e. its effects are always detrimental with no regard to the effects of other factors.

$$CO2_{i,t} = \beta_0 + \beta_1 FF_{i,t} + \beta_2 RE_{i,t} + \beta_3 RL_{i,t} + \beta_4 GDPC_{i,t} + \beta_5 FDI_{i,t} + \varepsilon_{i,t} \quad \text{Eq (1)}$$

To examine the moderating role of the legal framework, we introduce interaction terms between fossil fuel energy and the rule of law (Hypothesis 3), as shown in Eq (2).

$$CO2_{i,t} = \beta_0 + \beta_1 FF_{i,t} + \beta_2 RE_{i,t} + \beta_3 RL_{i,t} + \beta_4 (FF * RL)_{i,t} + \beta_5 GDPC_{i,t} + \beta_6 FDI_{i,t} + \varepsilon_{i,t} \quad \text{Eq (2)}$$

To determine the moderating role of the rule of law in the relationship between renewable energy and carbon dioxide emissions (Hypothesis 4), as shown in Eq (3).

$$CO2_{i,t} = \beta_0 + \beta_1 FF_{i,t} + \beta_2 R_{i,t} + \beta_3 RL_{i,t} + \beta_4 (R * RL)_{i,t} + \beta_5 GDPC_{i,t} + \beta_6 FDI_{i,t} + \varepsilon_{i,t} \quad \text{Eq (3)}$$

Equations 2 and 3 leave the direct links to look at the conditional effects. The interaction term (FF*RL or RE*RL) is what we will consider as the slope shifter of the energy-emission relationship. Rather than just taking the fossil fuel energy (FF) and renewable energy (RE) and making the same assumption about their impact, this model will test whether the impact does change with the improvement of the Rule of Law (RL). If the results show a negative coefficient (β_4) for the interaction between energy and the rule of law, it signifies a mitigation effect.

4. Results

4.1 Descriptive Result

Table 2 shows the descriptive statistics of the variables that will be used in the study, and it includes 333 observations in 37 developing economies. The mean carbon dioxide level (CO2) stands at 207.59 Mt CO2e, and its standard deviation (SD) is 502.58, which means that the environmental footprints of the sampled countries vary greatly. The use of fossil fuels (FF) remains the most common energy source, with a mean of 71.61, compared to 27.10 for renewable energy (RE). The score of Rule of Law (RL) is in the range of -1.37 to 1.91 with a mean of -0.037, which indicates that these developing economies, on average, score below the global mark in the quality of law and institutional quality.

Table 2: Descriptive Result of the Data

Variable	Obs	Mean	Std. Dev	Min	Max
CO2	333	207.59	502.58	1.11	2955.18
FDI	333	5.53	35.95	-296.01	431.79
GDPC	333	10767.53	10201.1	729.52	64572.01
FF	333	71.61	21.04	7.95	99.93
RE	333	27.10	20.10	0.4	86.3
RL	333	-0.037	0.68	-1.37	1.91

4.2 Regression Result

Table 3 provides a summary of the panel regression models. Three models have been estimated as the base model (1), the fossil fuel interaction with the rule of law model (2) and the renewable energy interaction with the rule of law model (3).

In Model 1, the consumption of fossil fuel (FF) has a positive and significant coefficient ($\beta = 10.30$, $p < 0.01$), which strongly supports the H1. This is a confirmation that the dependency on conventional sources of energy is still at the core of carbon emissions in these economies. On the other hand, renewable energy (RE) has a positive coefficient, but it is statistically insignificant in the baseline model; thus, it does not support H2 as a single mitigator in this case. It is also worth noting that the Rule of Law (RL) has a strong direct negative effect on emissions ($\beta = -101.9$, $p < 0.1$), which means that more powerful legal frameworks automatically lead to the improvement of the environment.

Interaction terms were added in order to test the conditional hypotheses. The correlation between the rule of law (FF $\times$ RL) and fossil fuels is negative and significant ($\beta = -1.920$, $p < 0.05$). This corroborates H3, which reveals that the carbon-intensive nature of the consumption of fossil fuels is greatly nullified in an event where a nation has a strong rule of law. Model 3 showed that renewable energy (RE) and the rule of law (RE $\times$ RL) had a positive coefficient, although statistically non-significant ($\beta = 0.746$). Therefore, H4 is not supported. This indicates that, at the present phase of development of these 37 economies, the legal framework is not yet at a point of providing a significant shift in terms of the performance of renewable energy implementation in lowering aggregate carbon emissions.

Table 3: Regression Result on the Impacts of Energy and Rule of Law on Carbon Dioxide Emissions

Model	(1)	(2)	(3)
Variables	CO2	CO2	CO2
FF	10.30*** (3.619)	10.11*** (3.580)	9.239** (3.616)
RE	6.264 (3.853)	6.633* (3.828)	4.810 (3.795)
GDP	-0.000712 (0.00411)	0.00154 (0.00421)	-0.00670** (0.00322)
FDI	-0.531 (0.754)	-0.456 (0.752)	-0.570 (0.757)
RL	-101.9* (59.81)		
FF*RL		-1.920** (0.823)	
RE*RL			0.746 (1.503)
Constant	-692.8* (368.6)	-711.9* (363.4)	-507.6
Observations	333	333	333
R-squared	0.062	0.069	0.054
Number of countries	37	37	37

Note: Standard errors in parentheses, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

5. Discussions

The primary research problem addressed in this study is the escalating challenge of carbon dioxide emissions in developing economies, specifically how institutional frameworks like the rule of law condition the environmental impact of energy consumption. We attempted to respond to the question: Does the consumption of fossil fuel and renewable energy have a direct effect on emissions, and does the rule of law serve as a moderating mechanism in these relationships? We have verified that although fossil fuel consumption is one of the main contributors to emissions, this influence is largely reduced by a sound legal framework. This observation is in accordance with a large amount of literature that recognises energy consumption as a primary predictor of carbon dioxide emissions (Massonini Ngoma et al., 2024). Nevertheless, the direct and moderated contributions of renewable energy in the sampled economies are statistically unimportant.

The first major finding indicates that fossil fuel energy consumption has a significant positive direct effect on carbon dioxide emissions. The coefficient of fossil fuel consumption, as depicted in Table 3 (Model 1), is positive and very significant, in that the use of traditional fossil fuel energy still stands out as the major cause of environmental degradation in the developing countries. This concurs with the scale effect in the Environmental Kuznets Curve (EKC) model, whereby the initial stage of industrialisation requires a high level of energy intensity that is mostly supplied by fossil fuels (Borozan & Borozan, 2025). Findings are in line with the already existing literature that has recognised fossil fuel reliance as one of the key predictors of increasing emissions in emerging economies that focus on speedy industrialisation (Massonini Ngoma et al., 2024).

One of the most important findings of the study is that the rule of law has a moderating effect on the effects of fossil fuels. The outcomes of Model 2 show that the carbon-intensive effect of the consumption of fossil fuel is considerably cut off as soon as it interacts with the rule of law. The latter is also greatly supported by Stef and Ben Jabeur (2020), who, in their review of 83 countries, confirmed the theory that the effectiveness of environmental laws should be accompanied by regulatory bodies that are able to enforce the law (Stef & Ben Jabeur, 2020). Furthermore, Imam et al. (2025) provide evidence of a similar institutional 'tipping point', whereby foreign investments and industrial operations change direction and become beneficial as soon as a threshold of the rule of law is achieved. This association implies that an effective legal system is a controlling mechanism that can be described as a mitigating tool, in that it ensures companies adhere to pollution control measures and that environmental protection rules are obeyed. From the perspective of New Institutional Economics, high-quality legal institutions reduce regulatory capture and promote compliance, effectively decoupling industrial activity from unrestricted pollution (H. S. Lee et al., 2021). This places the rule of law as a foundational requirement for "environmental stringency" as theorised in Ecological Modernisation Theory.

An unexpected finding is the statistically insignificant effect of renewable energy consumption on carbon dioxide emissions, both in its direct form and when moderated by the rule of law. While global trends generally suggest that transitioning to wind or solar

reduces the ecological footprint, our results (Table 2, Model 3) show no significant reduction in emissions. This result mirrors the findings of the past study (Wu & Bianchi, 2026), who noted that renewable energy adoption does not always result in an immediate decrease in carbon dioxide emissions in middle-income countries, likely due to its limited portion of the energy mix. This may be interpreted through the lens of ‘grid instability’ and high integration costs prevalent in many developing economies. The limited share of renewables in the total energy mix of the sampled countries—averaging only 27.10%—might not have reached the necessary threshold to produce a measurable impact on total carbon outputs. This finding highlights a ‘governance-technology gap’ where institutional strength alone cannot substitute for the physical infrastructure required for a successful energy transition. There is also what could be called a ‘sustainability paradox’. New technologies are often introduced to make energy systems cleaner and more efficient. However, many of these tools rely on powerful computers and large data centres that consume significant amounts of electricity. As a result, the advanced technologies meant to reduce environmental harm can themselves use so much energy that they weaken the overall sustainability effort. This challenge is even greater in developing countries. The financial gains from switching to clean energy usually appear slowly over time rather than all at once. When communities do not have reliable access to public power grids, or when electricity pricing systems are not flexible and supportive, it becomes much harder to realise the full benefits of renewable energy. In such situations, the connection between strong legal systems and the growth of clean energy remains more of a goal than a lived reality (Karisma, 2025).

6. Conclusions

The paper examines the connection between the rule of law, environmental quality, and energy consumption in thirty-seven developing economies between 2015 and 2023. The research was driven by the fact that carbon emissions have steadily increased, and little empirical attention on the relationship between the rule of law and the environmental implications of energy consumption. Empirical findings by our analysis indicate that although fossil fuel consumption is a key and unconditional factor in driving carbon dioxide emissions (H1), the rule of law is a very important moderating factor. In particular, the communication between fossil fuels and the power of laws shows that powerful institutional processes can greatly help to reduce the carbon-intensive effect of conventional energy sources (H3). On the other hand, the consumption of renewable energy has not produced a statistically significant effect on the overall emissions in the sample countries, despite the moderation by the quality of the legal framework (H2, H4). This study, in conclusion, shows that technological change alone is not the ultimate answer to climate sustainability in the developing world but is greatly dependent on the force of the legal rules of the game.

6.1 Theoretical Implications

The results can play an important role in the theoretical debate in the field of law, energy, and environmental economics. This paper confirms the empirical evidence of New

Institutional Economics (NIE) by supporting the moderating effect of the rule of law, which indicates that formal legal regulations are necessary in order to minimise regulatory capture and enhance environmental compliance. The findings also offer a fresh perspective on Ecological Modernisation Theory. They suggest that decoupling, which refers to the ability of an economy to grow without a corresponding increase in environmental damage, does not occur automatically as countries become more prosperous. Instead, it appears to require deliberate and thoughtful action. In particular, the evidence shows that this progress depends on how institutions respond to environmental challenges through clear laws, consistent enforcement, and accountable governance. Economic growth alone does not guarantee environmental improvement. Rather, cleaner and more sustainable development emerges when legal systems and public institutions consciously adapt and take responsibility for guiding that change. This paper is a study solving an institutional puzzle in that, though efficient institutions can lead to growth, they also offer the regulatory stringency of the environment that is necessary to curb the adverse externalities of such growth.

6.2 Practical Implications

From a policy and legal perspective, the empirical findings of this research carry significant implications for the implementation of Sustainable Development Goals 7, 13, and 16. They reinforce the understanding that a successful transition to sustainable energy cannot take place in the absence of a clear and functioning legal framework. Without coherent laws, effective institutions, and consistent enforcement, efforts to advance clean energy are unlikely to achieve lasting results. First and foremost, the governments of the developing economies should focus on consolidating the rule of law, namely, with respect to the enforcement of contracts and property rights, because these institutional characteristics are functional preconditions of the successful coping with the complex transition to the use of cleaner energy sources, instead of fossil fuels. The documented mitigation effect of the rule of law suggests that climate governance should no longer be viewed merely as a technical or purely environmental initiative. Instead, measures aimed at reducing corruption and strengthening legal transparency need to be directly incorporated into national climate action plans, where they can function as a regulatory safeguard against carbon-intensive industrial development. Lastly, the inability to obtain statistical significance of the effect of renewable energy, as demonstrated in this study, suggests that legal changes are not sufficient without parallel infrastructure and policy changes. To make a legally supported energy transition work, legislative enhancements should be accompanied by a significant investment in infrastructure to address the institutional challenges of grid instability and high integration costs that are currently holding back the decarbonization process of the developing world.

6.3 Limitations of the Study and Future Research Directions

This research is limited in some way in spite of its contributions. The aggregate data on the national level can conceal important differences in the practical application of the environmental laws on the sub-national level. The study period (2015–2023) also includes the initial stages of the Paris Agreement implementation; nevertheless, the long-term structural changes necessary in the case of the renewable energy transition might need a longer-term prism. Future studies can be done using disaggregated data to determine which particular aspects of the rule of law have the greatest impact on environmental quality (ex, civil justice or administrative effectiveness). Moreover, the researchers ought to examine the threshold effect of institutional quality in order to determine the exact level of legal development that is necessary to ensure that the investments in renewable energy sources have a statistically significant impact on the decrease in carbon footprints.

Acknowledgement

We sincerely thank the reviewers for their insightful comments and constructive feedback, which have greatly helped to improve the quality and clarity of this manuscript.

Funding Statement

The authors received no funding from any party for the research and publication of this article.

Authors' Contributions

Author 1 (Chew) collected data and wrote the original draft. Author 2 (Lee) analysed the data and edited the manuscript. Author 3 (Xie) reviewed the manuscript. All authors contributed to the final version and approved the submission.

Conflict of Interest Declaration

The authors declare that they have no conflict of interest in this study.

Ethics Approval

Ethical approval was not required for this study as it is based on doctrinal legal research involving the analysis of legislation, case law, and secondary sources, and does not involve human participants, personal data, or sensitive materials.

AI Usage Declaration

The author declares that Artificial Intelligence (AI) tools (ChatGPT) were used solely to assist with language editing and improvement of readability. No AI tools were used to

generate the substantive content, analysis, or conclusions of this manuscript. The author has reviewed and takes full responsibility for the content of this work.

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