Does access to clean energy reduce the poverty rate in Nigeria?

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Abstract

This study examines the impact of clean energy access on poverty reduction in Nigeria using annual data from 1990 to 2024 sourced from the World Development Indicators. The study employs the Johansen cointegration technique, Vector Error Correction Model (VECM), and Vector Autoregression (VAR) to analyse both short-run and long-run dynamics among poverty rate, clean energy access, renewable electricity output, and government infrastructure expenditure. The results reveal a significant long-run relationship among the variables, with clean energy access, renewable electricity output, and infrastructure spending all exhibiting negative and statistically significant impact on poverty level in Nigeria, while poverty demonstrates strong persistence over time. The impulse response and post-estimation diagnostics confirm model stability and reliability. The study recommends that to reduce poverty rate in Nigeria, there is need for the government at all levels to expand clean energy access and renewable generation, alongside sustained government investment in infrastructure. The study also recommends targeted policies to enhance affordability, project efficiency, and equitable distribution of modern energy services.
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Keywords: Clean energy access, Poverty, Renewable electricity output, VECM, VAR, Nigeria
JEL Classification: Q20, Q28, Q40, Q48, I32, C32

1.0   Introduction

Energy is a vital component of human existence and an indispensable driver of socio-economic development. It plays a fundamental role in the production, industrialization, and modernization of economies. Particularly, electricity is widely recognized as a catalyst for productivity and growth, as it enhances both capital and labour inputs (Nteegah & Ihejirika, 2024). Energy access has increasingly been recognised as a foundational element of human development, shaping households' ability to participate meaningfully in economic and social life. Clean and modern energy services, such as reliable electricity and non-polluting cooking fuels, are critical for improving health, supporting education, and enabling productivity within households and small enterprises (Pachauri & Spreng, 2004). In many developing contexts, energy poverty persists as a multidimensional challenge that reflects both limited access and the inability to afford sufficient, safe, and high-quality energy services (Abdoulaye & Mokaddem, 2023). Studies emphasise that the consequences of inadequate energy access extend beyond basic consumption, influencing livelihoods, gender roles, and opportunities for income generation (Pueyo & Maestre, 2019). These conceptual linkages highlight a broader development concern: without clean and reliable energy, households remain locked in cycles of deprivation, environmental exposure, and low productivity, limiting the potential for inclusive and sustainable economic progress.

Across Africa, countries such as Kenya, Morocco, and South Africa have made notable progress in expanding renewable energy access through policy reforms, public–private partnerships, and rural electrification initiatives (REN21, 2020). In South Africa, energy poverty, lack of access to sufficient, reliable, and clean energy, remains a major obstacle to

human development. Approximately 60% of rural households in South Africa still lack access to electricity, and more than 40% of those with access are considered energy poor, spending over 20% of their monthly income on electricity (Khobai, 2021). As a result, households often resort to traditional fuels such as wood and coal, exposing them to indoor air pollution, fire hazards, and health risks. This dependence on unsafe energy perpetuates the cycle of poverty by undermining health, reducing productivity, and constraining opportunities for education and income generation (Okeoma, 2023).

Access to modern and clean energy services remains a major challenge in Nigeria. Although 60.5% of the population had access to electricity in 2022, with rural access as low as 27% (World Bank, 2022), these headline figures overstate effective access to clean energy, as a large share of households and firms classified as electrified rely extensively on diesel and petrol generators due to unreliable grid supply (IEA, 2022). From a clean energy perspective, Nigeria performs poorly: renewable electricity (excluding large hydropower) accounts for a limited share of total generation, decentralized solar systems reach only a small fraction of households, and more than 80% of Nigerians depend on traditional biomass for cooking, reflecting very low access to clean cooking energy (World Bank, 2022; IEA, 2022). These energy access deficits are closely intertwined with Nigeria's broader development challenges, as the country faces acute multidimensional poverty, with an estimated 133 million people classified as poor and 44.7% of the population living in absolute poverty (National Bureau of Statistics [NBS], 2022), underscoring the central role of expanding access to clean, reliable, and affordable energy in advancing poverty reduction and inclusive growth.

The persistence of energy poverty in Nigeria underscores the need to examine how clean energy access may serve as a pathway out of poverty. Despite various policy initiatives, millions of Nigerians continue to rely on traditional biomass, face unreliable electricity supply, or depend on costly alternative energy sources, conditions similar to those documented among poor households in Ghana, Pakistan, Nepal, and other developing settings (Bloomer & Boateng, 2024; Awan et al., 2022; Malla, 2013). Such constraints not only reinforce existing welfare disparities but also deepen the rural–urban energy access gap, a phenomenon observed in several developing countries where structural limitations hinder equitable access to modern energy services (Acheampong et al., 2025).

Due to the poor access to electricity in the country, millions of Nigerians, especially in rural communities, continue to rely on traditional biomass such as firewood, charcoal, and kerosene for cooking and lighting. Such reliance not only causes deforestation and health hazards due to indoor pollution but also perpetuates poverty by keeping households outside the benefits of modern energy (Okeoma et al., 2023). In energy-poor households, high expenditure on inefficient fuels crowds out spending on food, education, and healthcare, while the absence of clean electricity constrains income-generating activities, human capital development, and overall welfare. These challenges are reflected in Nigeria's persistently high poverty levels. Emerging global evidence suggests that when households gain access to clean and affordable energy, whether through renewable energy adoption, regulatory reforms, or targeted interventions, energy-related deprivation tends to decline and welfare outcomes improve (Ma et al., 2022; Jithin & Renjith, 2025). Yet, for Nigeria, there remains limited empirical clarity on whether enhanced clean energy access actually translates into measurable reductions in poverty. Recognizing these challenges, the Federal Government of Nigeria has developed several policy frameworks aimed at promoting renewable energy and reducing poverty, including the National Renewable Energy and Energy Efficiency Policy (2017) and the Energy Transition Plan (ETP, 2022). These initiatives seek to increase the share of renewables in the national energy mix and achieve universal energy access by 2030. However, implementation

has been constrained by inadequate financing, poor infrastructure, and weak institutional capacity.

This study is therefore motivated by the imperative to understand the relationship between clean energy access and poverty reduction, and to generate evidence capable of informing policy reforms aimed at accelerating Nigeria's progress toward sustainable development and poverty eradication. Understanding these linkages will not only provide evidence for policy formulation but also contribute 'to achieving the Sustainable Development Goals (SDGs), particularly Goal 1 (No Poverty) and Goal 7 (Affordable and Clean Energy). This study is organized into five key sections. Following the introduction in Section One, Section Two presents a detailed review of relevant theoretical and empirical literature; Section Three outlines the methodological framework and model specification; Section Four discusses the empirical results and their implications; and Section Five concludes the study with a summary of findings, policy recommendations, and suggestions for future research.

2.0   Literature Review

Various literature on clean energy access and poverty reduction is reviewed in this section. For clarity, this section is segmented into three – conceptual review, theoretical review, and empirical review.

2.1   Conceptual Review

Energy access and energy poverty are central concepts in understanding the relationship between clean energy and welfare outcomes in developing countries. Energy poverty refers to a condition in which households lack access to affordable, reliable, and modern energy services necessary for basic living and productive activities (Abdoulaye & Mokaddem, 2023). It is multidimensional, encompassing not only physical access but also affordability, quality, and consistency of supply. Pachauri and Spreng (2004) conceptualise energy access as a fundamental component of human welfare, linking it to capabilities such as education, health, and income generation. This broader perspective positions clean energy access as a catalyst for poverty reduction, as households with modern energy can engage in economic activities, improve productivity, and enhance living standards.

Recent conceptual debates also highlight the interaction between energy access, gender, and structural inequalities. Pueyo and Maestre (2019) argue that access to clean energy has transformative effects on productive uses, particularly for women, by reducing time spent on fuel collection and enabling participation in income-generating activities. Studies from Nepal, Pakistan, and Ghana underscore that when households rely on biomass or prepaid electricity systems, they face higher deprivation, environmental risks, and reduced welfare prospects (Malla, 2013; Awan et al., 2022; Bloomer & Boateng, 2024). Clean energy access is therefore conceptualised as both a welfare good and a development input that reduces vulnerability, expands opportunities, and improves long-term household resilience. This conceptual framing underpins the present study's focus on how access to clean energy may reduce poverty in Nigeria.

2.2   Theoretical Review

This study is anchored on the Energy Transition Theory, which explains how societies move progressively from traditional biomass-based systems to modern, efficient, and sustainable energy sources as income levels rise and technology advances. The theory posits that such transitions enhance productivity, expand economic opportunities, and drive improvements in welfare. It supports the argument that access to modern energy, particularly electricity, acts as

a catalyst for economic development by enabling industrial activity, supporting small enterprises, improving health outcomes, and enhancing educational attainment.

The energy transition framework aligns with the insights of Pachauri and Spreng (2004), who argue that modern energy access directly influences poverty through capability enhancement. It also resonates with evidence showing that shifts toward renewable energy and environmentally sustainable systems reduce both deprivation and environmental risks (Ma et al., 2022; Jithin & Renjith, 2025). The theory further accommodates the rural–urban disparities emphasised by Acheampong et al. (2025), who note that structural constraints often determine the pace and inclusiveness of energy transitions. In essence, the theoretical lens suggests that improvements in clean energy access should contribute to poverty reduction through economic, social, and environmental pathways, providing a robust justification for empirically examining this relationship in Nigeria.

2.3   Empirical Review

Empirical studies across diverse contexts consistently indicate that access to clean or modern energy enhances welfare and reduces poverty, although the magnitude of the effect varies by governance quality, infrastructure, and policy design. Bloomer and Boateng (2024) find that prepaid energy systems in urban Ghana often deepen poverty by imposing high upfront costs and limiting households' ability to smooth consumption. In Pakistan, Awan et al. (2022) reveal a persistent pattern of energy poverty driven by income constraints, demographic factors, and infrastructural deficits. Similarly, Malla (2013) shows that traditional fuel use in Nepal is associated with health risks and reduced productivity, highlighting the welfare costs of inadequate modern energy access.

Emerging cross-country studies also offer strong evidence for the poverty-reducing effects of clean energy. Ma et al. (2022) found that environmental regulations and expanded clean energy access reduce household energy poverty in China, while Jithin and Renjith (2025) show that renewable energy consumption significantly lowers energy poverty across developing countries. Acheampong et al. (2025) emphasise that remittances can close rural–urban energy gaps, thereby reducing energy-related deprivation. These findings complement earlier studies linking energy access to higher household welfare, improved consumption, and better socio-economic outcomes.

Additional empirical studies provide further support. In Nigeria, Amadi (2017) highlights the potential of renewable energy to reduce unemployment and poverty, while Nteegah and Ihejirika (2024) find that electricity generation and access significantly reduce poverty using ARDL techniques. Rahim et al. (2025) show that electricity consumption and road infrastructure promote poverty reduction across developing countries, underscoring infrastructure's mediating role. Country-specific studies such as Diallo and Moussa (2024) for Côte d'Ivoire and Lu et al. (2023) for 98 developing nations confirm that electricity access and clean energy development improve living standards, per capita income, and productivity.

For Nigeria specifically, Balogun and Oloja-Ojabo (2023), Ahmed et al. (2022), and Elerie (2018) provide consistent evidence that renewable energy consumption, electricity generation, and modern energy access significantly reduce poverty in the long run, though governance inefficiencies and unstable supply limit overall effectiveness. Broader analyses such as Chen et al. (2024) further demonstrate that renewable energy consumption reduces both poverty and carbon emissions, reinforcing the dual economic–environmental benefits of clean energy transitions.

Collectively, these empirical studies underscore the potential of clean energy access, renewable energy expansion, and infrastructural investment to sustainably reduce poverty. However, variations in institutional capacity, financing, and policy implementation highlight the need for country-specific analysis. This study therefore investigates how access to clean energy, renewable electricity output, and government infrastructure expenditure interact to influence poverty reduction in Nigeria from 1990–2024.

3.0   Methodology

This study adapts the energy transition theory and the model proposed by Diallo and Moussa (2024) in a similar study. The modified model is presented thus:

$$POV = f\left(CEA, REO, GIE\right) \tag{1}$$

where, POV is poverty rate; CEA is clean energy access; REO is renewable electricity output; and GIE is government infrastructure expenditure. The model is presented in the econometrics form as follow:

$$POV_t = \alpha_0 + \alpha_1 CEA_t + \alpha_2 REO_t + \alpha_3 GIE_t + \mu_t \tag{2}$$

In equation (2), subscript t denotes the timeseries nature of the data (1990 to 2024); μ represents the error term, α_0 is the constant term; α_1, α_2, and α_3 are the elasticity coefficient of poverty rate in respect to CEA, REO and GIE, respectively. 'The data used in this study is obtained from the World Bank, World Development Indicators'(WDI), and analysed using Eviews version 12. The dependent variable is poverty rate, measured using the multidimensional poverty headcount ratio (World Bank) as the percentage of the population living in poverty according to the World Bank's Multidimensional Poverty Measure. The key explanatory variables include clean energy access, defined as the percentage of the population with access to electricity, and renewable electricity output, measured as the share of electrify generated by renewable power plants in total electricity generated by all types of plants. Both indicators were obtained from the World Development Indicators (WDI) database of the World Bank. Additionally, government infrastructural expenditure, expressed in U.S. dollars, represents total public investment in infrastructure and was also sourced from the WDI. This variable was logged before conducting the analysis. These variables were selected to capture the key dimensions of energy access, renewable generation, and public investment that collectively influence poverty outcomes in Nigeria during the study period (1990 – 2024).

For log-log interpretation of the relationship among the variables, all the variables in the model are logged and presented thus:

$$\ln POV_t = \alpha_0 + \alpha_1 \ln CEA_t + \alpha_2 \ln REO_t + \alpha_3 \ln GIE_t + \mu_t \tag{3}$$

4.0   Results and Data Presentation

4.1   Descriptive statistics

The summary statistics in Table 1 present key characteristics of the variables, including their mean, median, minimum and maximum values, standard deviation, skewness, kurtosis,' Jarque–Bera (JB) statistic, probability values, and the number of observations. The poverty variable (lPOV) has a mean of 3.704 and a standard deviation of 0.256, indicating moderate variability around its central value. Its positive skewness (0.399) and low kurtosis (1.288) suggest a distribution slightly tilted to the right and flatter than a normal distribution. The JB

probability (0.074) indicates mild deviation from normality. Clean energy access (lCEA) records a mean of 3.864 with a standard deviation of 0.189, reflecting relatively low dispersion. Its negative skewness (–0.800) and kurtosis of 3.324 imply a left-skewed distribution with moderately heavy tails. The JB probability of 0.143 suggests the series is not significantly different from normal distribution at the 5% level. Renewable electricity output (lREO) has a mean of 3.350 and standard deviation of 0.351, showing higher variability compared to lCEA. With slight negative skewness (–0.357) and kurtosis of 2.080, the distribution is mildly left-skewed with near-normal peakness. The high JB probability (0.372) confirms that the series aligns reasonably well with normality. Government infrastructure expenditure (lGIE) displays a mean of 5.715 and a relatively small standard deviation of 0.100, indicating strong stability in the series. Its skewness (0.204) suggests a slight rightward tilt, while a kurtosis of 2.047 indicates a distribution close to normal. The JB probability of 0.457 further supports normality. The descriptive statistics indicate that while all variables show moderate variation, most display distributional properties that do not significantly diverge from normality, making them suitable for further econometric analysis.

Table 1: Summary statistics.

	lPOV	*lCEA*	*lREO*	*lGIE*
Mean	3.703887	3.863670	3.350380	5.714796
Medium	3.547086	3.912023	3.493597	5.702629
Maximum	4.067650	4.114147	4.001042	5.929775
Minimum	3.429568	3.306887	2.663846	5.548758
Std. Dev	0.255751	0.189382	0.350693	0.100022
Skewness	0.399400	-0.799919	-0.356642	0.204330
Kurtosis	1.288216	3.324052	2.080036	2.047160
Jarque-Bera	5.203752	3.885715	1.976198	1.567571
Probability	0.074134	0.143294	0.372284	0.456674
Observations	35	35	35	35

Source: Authors' computation (2025)

4.3   Stationarity test

The Augmented Dickey-Fuller (ADF) test was conducted to ascertain the stationarity properties of the variables in the model. The test results are shown in Table 2. At levels, all the variables, exhibit non-stationarity, as indicated by their statistically insignificant p-values. However, after first differencing, each variable becomes stationary, with test statistics of –4.262735 for lPOV, –5.648242 for lCEA, –6.376315 for lREO, and –6.017722 for lGIE, all associated with highly significant p-values. These results confirm that lPOV, lCEA, lREO, and lGIE are integrated of order one, I(1), and provides a suitable basis for applying the Johansen cointegration testing approach to explore potential long-run relationships among the variables.

Table 2: Unit root test results.

Variables	Levels	First difference	Order of Integration
	t-stat.	t-stat.	
lPOV	-2.218897	-4.262735**	I(1)
lCEA	-2.369826	-5.648242***	I(1)
lREO	-2.356752	-6.376315***	I(1)
lGIE	-2.908803	-6.017722***	I(1)

** and *** indicate significance at 5% and 1% levels, respectively.
Source: Authors' computation (2025)

4.4 Johansen Cointegration test result

The Johansen cointegration test was employed to determine whether a long-run equilibrium relationship exists among the variables in the model.' As reported in Table 3, both the Trace and Maximum Eigenvalue statistics provide strong evidence of cointegration. The Trace statistic (63.94404) exceeds the 0.05 critical value of 47.85613, with a corresponding probability of 0.0008, indicating that at least one cointegrating equation exists. Similarly, the Maximum Eigenvalue statistic (46.71622) is greater than its 0.05 critical value of 27.58434, with a probability value of 0.0001. These results jointly confirm the presence of one significant cointegrating relationship among the variables. The existence of cointegration implies that the variables move together in the long run and share a stable equilibrium relationship, and satisfy the condition to estimate the Vector error Correction model.

Table 3: Johansen Cointegration Test result.

Unrestricted Cointegration Rank Test (Trace)			
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value
None*	0.767736	63.94404***	47.85613
At most 1	0.197321	17.22782	29.79707
At most 2	0.189741	10.19419	15.49471
At most 3	0.102523	3.461360	3.841465
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)			
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistics	0.05 Critical Value
None*	0.767736	46.71622***	27.58434
At most 1	0.197321	7.033630	21.13162
At most 2	0.189741	6.732827	14.26460
At most 3	0.102523	3.461360	3.841465

Both Trace and Max-eigenvalue tests indicate 1 cointegrating eqn at the 0.01 level.
Source: Authors' computation (2025)

Table 4: Vector Error Correction Model (VECM) result.

Dependent variable = *lPOV*	
Variables	Coefficients
ECT	-0.038162**
ΔlPOV(-1)	0.366602**
ΔlCEA	-0.279265**
ΔlREO	-0.052200**
ΔlGIE	-0.255374**
C	-0.002700**

** indicates 5% significance level.
Source: Authors' computation (2025)

The short-run VECM results show that poverty dynamics adjust gradually toward long-run equilibrium, as indicated by the negative and significant error correction term (–0.038162, p = 0.02392), which reveals that about 3.8% of deviations from the long-run path are corrected annually. The lagged change in poverty exerts a positive and significant effect (0.366602),

suggesting short-run persistence in poverty levels. Clean energy access significantly reduces poverty in the short run (–0.279265, p = 0.01616), while renewable electricity output also contributes to poverty reduction, though with a smaller effect (–0.052200, p = 0.04604). Likewise, government infrastructure expenditure lowers poverty in the short run (–0.255374, p = 0.01802), highlighting the welfare-enhancing role of public investment. The negative and significant constant term further indicates a mild structural tendency for poverty to decline over time. Overall, the results demonstrate that improvements in energy access, renewable energy generation, and government spending all play important roles in reducing poverty in the short run while the system gradually moves back toward long-run equilibrium.

Although the existence of cointegration among the variables warrants the estimation of a VECM as the primary estimation framework, a Vector Autoregression (VAR) model is additionally estimated as a robustness exercise to examine the persistence and short-run dynamic interactions among poverty, clean energy access, renewable electricity output, and government infrastructure expenditure. Unlike the VECM, the VAR does not impose long-run equilibrium restrictions, thereby allowing an assessment of whether the estimated poverty–energy relationships remain stable when the cointegrating structure is relaxed. This complementary approach strengthens the credibility of the results and provides additional insights into the dynamic inertia and feedback mechanisms characterizing poverty in Nigeria.

The VAR results as presented in Table 5 indicate that past poverty levels strongly influence current poverty, as shown by the positive and significant coefficient (0.810385, p = 0.02776), suggesting a high degree of persistence in poverty over time. Clean energy access exerts a negative and significant impact on poverty (–0.258496, p = 0.01266), implying that improvements in access to clean energy contribute to reducing poverty levels. Similarly, renewable electricity output has a modest but significant negative effect (–0.041148, p = 0.04889), indicating that increases in renewable generation support poverty reduction. Government infrastructure expenditure also lowers poverty in the model (–0.147957, p = 0.01745), reinforcing the importance of public investment in improving welfare outcomes. The positive and significant constant term reflects underlying structural factors affecting poverty.

Table 5: Vector Autoregression (VAR) results.

Dependent variable = *lPOV*	
Variables	Coefficients
lPOV(-1)	0.810385**
lCEA	-0.258496**
lREO	-0.041148**
lGIE	-0.147957**
C	2.668694**

** indicates 5% significance level.
Source: Authors' computation (2025)

The VECM and VAR results align strongly with the Energy Transition Theory and the broader empirical evidence, confirming that improved access to modern and renewable energy sources contributes to poverty reduction in Nigeria. The significant negative short-run effects of clean energy access and renewable electricity output on poverty in both models, consistent with Pueyo and Maestre (2019), Ma et al. (2022), and Jithin and Renjith (2025), reflect the theory's assertion that modern energy enhances welfare by improving productivity, health, and educational outcomes. This is further supported by the significant poverty-reducing effect of government infrastructure expenditure, which parallels Rahim et al. (2025) and Acheampong

et al. (2025), who argue that infrastructural investment and structural conditions shape the inclusiveness of energy transitions. The persistence of poverty indicated by the lagged terms in both VECM and VAR also mirrors findings by Awan et al. (2022) and Malla (2013), who emphasize that structural and demographic constraints slow down welfare improvements even when energy access expands. However, while studies such as Bloomer and Boateng (2024) show that certain forms of modern energy access (e.g., prepaid electricity) can worsen poverty due to affordability barriers, the current results contrast with this by showing consistently beneficial effects of clean energy access, suggesting that in Nigeria's context, modern energy services may be less financially restrictive or accompanied by complementary infrastructure. The results further reinforce Nigerian studies (Amadi 2017; Nteegah & Ihejirika 2024; Balogun & Oloja-Ojabo 2023) which find that renewable energy, electricity access, and public investment reduce poverty, although they also caution about governance and supply constraints. The statistically significant but slow adjustment rate in the VECM (3.8% correction annually) supports Acheampong et al.'s (2025) argument that structural inequalities moderate the pace of energy transitions, underscoring the need for deeper reforms.

4.5   Post Estimation test results

The impulse response results (Figure 1) show that shocks to clean energy access, renewable electricity output, and government infrastructure expenditure all generate sustained declines in poverty over time, indicating that improvements in modern energy access and infrastructural investment have persistent welfare-enhancing effects. The negative responses of poverty to these shocks reinforce the VECM and VAR findings, which also showed significant short-run poverty reduction effects from clean energy, renewable electricity, and government spending. The AR Roots graph (Figure 2) further confirms that all inverse roots lie within the unit circle, indicating that the VAR model is dynamically stable and that the impulse response functions are reliable for interpretation. Additionally, the post-estimation tests (Table 6) validate the robustness of the model: the residuals are normally distributed ($p = 0.4485$), there is no evidence of serial correlation ($p = 0.1248$), heteroscedasticity is absent ($p = 0.6308$), and the Ramsey RESET test ($p = 0.9962$) confirms correct model specification. Together, these results demonstrate that the model is stable, well-specified, and econometrically sound, lending strong credibility to the conclusion that energy access, renewable energy generation, and government infrastructure spending play significant roles in reducing poverty in Nigeria both in the short and long run.
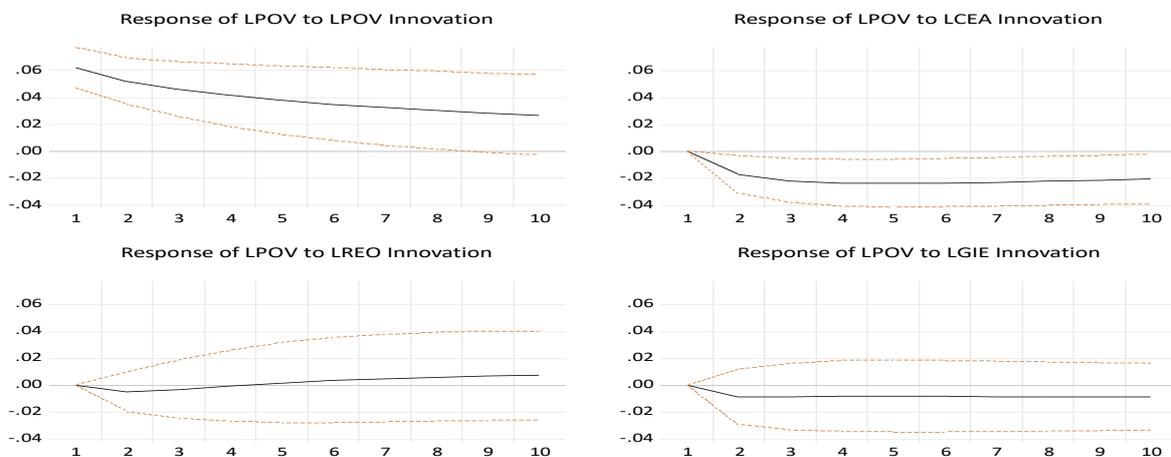

Figure 1: Impulse response results.

Source: Authors' computation (2025)

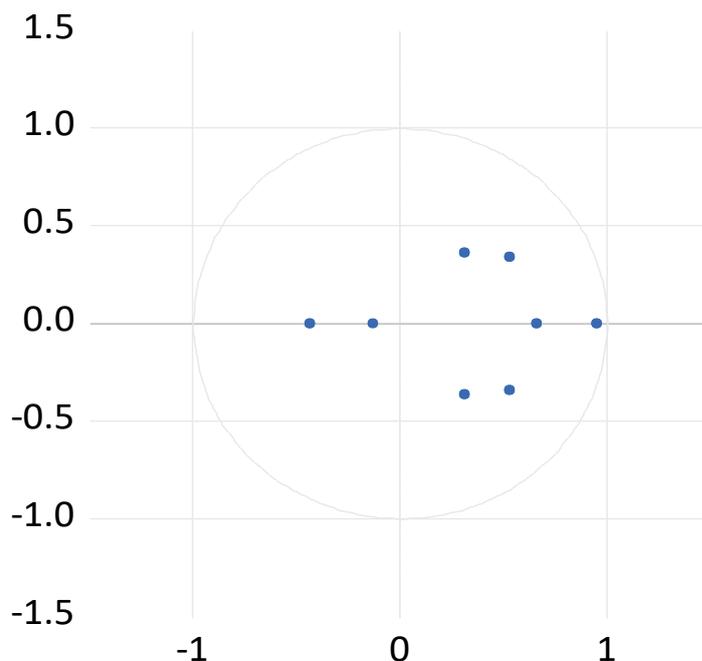## Inverse Roots of AR Characteristic Polynomial

Figure 2: AR Roots graph results.

Source: Authors' computation (2025)

Table 6: Post estimation tests results.

	F-statistics	*P-value*
Normality	1.603762	0.4485
Serial correlation	2.530028	0.1248
Heteroscedasticity	0.827852	0.6308
Ramsey RESET	2.39E-05	0.9962

Source: Authors' computation (2025)

5.0   Conclusion and Recommendations

This study investigates the effect of clean energy access on poverty reduction in Nigeria using annual data from the World Development Indicators and a model adapted from Diallo and Moussa (2024) within the framework of the Energy Transition Theory. The empirical analysis employed the, Johansen cointegration technique, Vector Error Correction Model (VECM), and Vector Autoregression (VAR) to capture both the long-run equilibrium relationship and the short-run dynamics among poverty rate, clean energy access, renewable electricity output, and government infrastructure expenditure. The stationarity tests confirmed that all variables were integrated of order one, while the Johansen test established the existence of a stable long-run cointegrating relationship among the variables. The VECM results showed a slow but significant speed of adjustment toward long-run equilibrium and demonstrated that improvements in clean energy access, renewable electricity output, and government infrastructure spending significantly reduce poverty in the short run. Similarly, the VAR findings indicated strong persistence in poverty levels and reinforced the poverty-reducing effects of modern energy access and public investment (government infrastructure expenditure). These results validate the Energy Transition Theory by demonstrating that access

to modern and sustainable energy enhances welfare through productivity improvements, reduced energy deprivation, and improved social outcomes. They are also broadly consistent with empirical evidence from both developing countries and Nigeria, which shows that clean energy and infrastructural development play vital roles in reducing household poverty.

Based on the study's findings, it is recommended that policymakers prioritize the expansion of clean energy access and renewable electricity generation, as both significantly reduce poverty. This can be achieved by increasing funding for solar mini-grids, off-grid renewable solutions, and last-mile electrification projects, especially in underserved rural areas. Government should also scale up infrastructure investment by strengthening public–private partnerships, improving project monitoring systems, and ensuring timely completion of energy and infrastructure projects to maximize their welfare impact. To sustain affordability, regulators should implement targeted subsidies for low-income households, promote flexible payment systems, and reduce tariffs on renewable energy technologies. Addressing structural barriers, such as weak grid networks and regional disparities, requires upgrading transmission infrastructure and decentralizing energy planning to better reflect local needs.

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