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Original Research Article

The Role of Renewable Energy Investment in Sustainable Economic Development in Nigeria

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Abstract: This study assessed the impact of renewable energy investment on sustainable economic development in Nigeria. Sustainable economic development was measured by the growth rate of gross domestic product, while renewable energy was proxied by solar, wind, and biomass. Data on these variables for the period 1990 to 2023 were analysed using the Augmented Dickey-Fuller unit root test, Johansen Cointegration test and the Error Correction Model approach. The unit root test result reveal that all the variables became stationary at first difference. The Johansen Cointgration test also reveal the presence of long run relationship among the variables. Findings from the ECM estimates show that investment in solar energy has a considerable positive impact on the growth of Nigeria's gross domestic product, while investment in wind energy has an insignificant positive impact on the growth of Nigeria's gross domestic product. The study also disclosed that investment in biomass has a non-negligible positive influence on the growth of gross domestic product in Nigeria. Based on these findings, the study concludes that investment in renewable energy contributes positively to sustainable economic development in Nigeria, and recommends that the Nigerian government should prioritize solar energy investment by creating favourable policies that attract both local and international investors, and as well, encourage collaboration among stakeholders in the agricultural, environmental, and energy sectors to develop a structured biomass energy policy that focus on converting agricultural waste into energy, thereby promoting environmental sustainability while contributing to economic development.
Keywords: Renewable Energy, Solar, Wind, Biomass, Sustainable Economic Development.

1.0 INTRODUCTION

Nigeria faces a persistent paradox in its energy sector: despite being richly endowed with renewable energy resources such as solar, wind, hydro, and biomass, millions of Nigerians remain without reliable access to electricity. As of 2023, about 45% of the population, particularly in rural areas, lacked grid-connected electricity (Adebayo & Alimi, 2023). This energy deficit continues to hamper economic activities, worsen poverty, and stall progress toward sustainable development. The low level of investment in renewable energy infrastructure has thus become a significant constraint on Nigeria's quest for inclusive and sustainable economic growth.

While global trends show an increasing shift toward clean and renewable energy investments, Nigeria lags behind due to a mixture of financial, institutional, and policy-related barriers. According to Bello and Aremu (2022), private sector investment in Nigeria's renewable energy sector is undermined by regulatory uncertainties, high capital costs, weak grid infrastructure, and a lack of incentives for investors. These issues have led to a slow adoption of renewable technologies and limited diversification of the national energy mix.

Furthermore, although policies such as the Renewable Energy Master Plan and the National Energy Policy exist, their implementation has been marred by political inconsistency, inadequate funding, and weak institutional frameworks (Olatunji & Uchenna, 2023). These gaps have contributed to Nigeria's failure to leverage renewable energy as a driver of economic transformation, employment creation, and climate change mitigation. Empirical studies reveal that countries that strategically invest in renewables experience stronger macroeconomic indicators and better human development outcomes (Nwachukwu & Chukwu, 2022). However, Nigeria's renewable energy contribution to electricity generation remains below 10%, significantly lower than the African average.

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Another pressing concern is the uneven distribution of energy access across regions, which contributes to socio-economic disparities. Rural communities in the North and Niger Delta, for instance, are disproportionately affected by energy poverty. These areas could benefit significantly from decentralized renewable solutions like solar mini-grids and small hydro plants, but investment in such technologies remains minimal due to perceived risks and inadequate financing models (Okonkwo & Onwukwe, 2021). Consequently, local enterprises, schools, and health centers struggle to function effectively, undermining sustainable development at the grassroots level.

The lack of a coherent investment strategy in renewable energy also threatens Nigeria's ability to meet its Sustainable Development Goals (SDGs), particularly Goals 7 (Affordable and Clean Energy), 8 (Decent Work and Economic Growth), and 13 (Climate Action). As noted by Eze and Maduka (2022), the continued dependence on fossil fuels and insufficient investment in renewables make Nigeria vulnerable to external oil shocks, environmental degradation, and missed opportunities in green job creation.

In light of these challenges, it becomes imperative to critically examine the role of renewable energy investment in Nigeria's sustainable economic development. Understanding the constraints and opportunities for scaling up investment in this sector is essential to crafting effective policies and attracting the necessary public and private capital required to transform the economy and improve the quality of life for citizens. The main objective of this study therefore, is to examine the relationship between renewable energy investment and economic development in Nigeria. The specific objectives of the study are to: examine the impact of investment in Solar Energy on the growth of gross domestic product in Nigeria; evaluate the effect of public and private sector funding in Wind Energy on the growth of gross domestic product in Nigeria; and investigate the relationship between investment in Biomass Energy and the growth of gross domestic product in Nigeria.

2.0 LITERATURE REVIEW

2.1 Conceptual Literature

Investment in Renewable Energy

Investment in renewable energy refers to the allocation of financial resources toward the development, installation, maintenance, and promotion of energy systems that rely on naturally replenishing sources such as solar, wind, hydro, and biomass. These investments are essential for transitioning from fossil fuels to cleaner and more sustainable energy sources (Oyedepo *et al.*, 2020). Renewable energy investments can be made by public institutions, private companies, international organizations, or through public-private partnerships.

Investment in Solar Energy

Solar energy investment focuses on deploying technologies that harness sunlight to generate electricity or heat, including photovoltaic (PV) systems and solar thermal plants. Nigeria, located within the tropical belt, receives high solar irradiance of 4.0 to 6.5 kWh/m² per day, making it highly suitable for solar energy development (Iloeje *et al.,* 2023). Investment in this sector includes government-funded rural electrification projects, donor-supported programs, and private sector-led solar mini-grid and solar home system initiatives.

Adefarati and Bansal (2019) emphasized that solar energy investments have a profound impact on energy access in off-grid communities, which in turn enhances education, healthcare delivery, and productivity. Yet, the uptake has been constrained by inadequate policy support, low consumer purchasing power, and high equipment import costs (Adeyemi & Olowolafe, 2021). Recent initiatives like the Nigeria Electrification Project (NEP) have, however, spurred increased attention to solar investments with significant economic implications.

Investment in Wind Energy

Wind energy investment involves capital deployment in wind turbines and related infrastructure to convert wind kinetic energy into electricity. Although Nigeria's wind energy potential is relatively moderate and geographically limited—mostly in the northern regions and coastal areas—it remains underutilized (Oladipo & Mohammed, 2022).

Investment in Biomass

Biomass energy refers to energy produced from organic materials such as agricultural waste, wood, and animal dung. Investment in biomass energy involves the establishment of biogas plants, biomass combustion systems, and other waste-to-energy facilities. In Nigeria, where agricultural and organic waste is abundant, biomass has considerable potential for both rural and urban energy supply.

According to Eze and Nnaji (2023), biomass investment not only helps manage waste but also generates energy for cooking, heating, and electricity, thereby enhancing local economies and reducing environmental pollution. In rural Nigeria, small-scale biomass projects have been shown to improve household incomes and support local entrepreneurship. However, challenges such as low technological adoption, lack of awareness, and insufficient policy support have limited its scale-up (Ibrahim & Abubakar, 2020).

Economic Development

Economic development is a broad concept that encompasses improvements in living standards, poverty reduction, increased employment, industrialization, infrastructure expansion, and environmental sustainability. It goes beyond mere economic growth by focusing on qualitative improvements in human well-being (Todaro & Smith, 2021).

In the Nigerian context, economic development has been hindered by infrastructural deficits, over-reliance on oil exports, and weak diversification. Investment in renewable energy presents an opportunity to reverse this trend by fostering energy access, supporting SMEs, creating green jobs, and reducing environmental degradation. As Uche and Olayemi (2023) note, countries that integrate clean energy strategies into their development plans experience more stable and inclusive growth patterns than those dependent on fossil fuels.

Renewable Energy and Sustainable Development in Nigeria

Renewable energy supports sustainable development through several mechanisms. Economically, it promotes job creation and enhances industrial productivity. Okafor and Chukwu (2023) demonstrate that investments in off-grid solar mini-grids in rural areas not only improve household welfare but also stimulate micro-enterprise growth. Socially, renewable energy improves education and health outcomes by powering schools and health centers, particularly in remote communities. Environmentally, it reduces Nigeria's carbon footprint and aligns with the Paris Climate Agreement targets.

Moreover, the deployment of renewable energy technologies fosters innovation and human capital development. According to Nnaji and Obikeze (2023), local capacity-building programs in solar panel installation and maintenance have empowered Nigerian youths with employable green skills, contributing to social inclusion and reducing youth unemployment.

However, the potential of renewable energy in achieving sustainable development in Nigeria is hampered by inadequate financing, policy inconsistency, and infrastructural deficits. While private sector investment has begun to rise, there remains a large gap in access to funding for small and medium-scale renewable projects (Akinbami *et al.,* 2023). Additionally, regulatory and bureaucratic challenges often deter investment in the renewable energy sector.

To ensure that renewable energy truly contributes to sustainable development, Nigeria must enhance policy coherence, invest in research and development, and promote public-private partnerships. An inclusive energy strategy that emphasizes affordability, reliability, and environmental sustainability is key to realizing the full benefits of renewable energy in advancing Nigeria's development agenda.

2.2 Empirical Literature

Edet and Nwachukwu (2024) employed Structural Equation Modeling (SEM) to determine how renewable energy finance indirectly affects human development in Nigeria. Using data from 2000 to 2022, the study measured human development index (HDI) proxies—literacy rates, life expectancy, and access to electricity—while linking them to renewable energy funding, government policy indices, and infrastructure development. The findings suggested that increases in renewable energy finance significantly enhanced access to basic services, which in turn elevated HDI scores. The authors concluded that renewable energy investments act as catalytic platforms for social development and wellbeing.

Balogun and Adeyemi (2024) adopted a Bayesian Vector Autoregression (BVAR) model to explore the response of Nigeria's economic sustainability indicators—GDP per capita, employment rate, and environmental index—to renewable energy shocks. Using quarterly data from 2001 to 2023, the study found that positive shocks in renewable energy investment led to long-lasting improvements in economic sustainability. The authors proposed that policy prioritization of decentralized renewable systems would cushion the effects of fossil fuel volatility on development.

Chinonso and Okeke (2023) utilized the Multivariate Adaptive Regression Splines (MARS) technique to assess nonlinear relationships between renewable energy investment and poverty alleviation in Nigeria from 2000 to 2021. The study analyzed poverty rate as the dependent variable and renewable energy expenditure, access to electricity, and job creation as predictors. The MARS model identified thresholds where renewable energy investments became significantly impactful, especially in regions with previous energy deprivation. The study recommended scaling renewable energy in off-grid areas for maximum poverty reduction effects.

Nwankwo and Yusuf (2023) applied the Tobit regression model to explore what drives private sector investment in renewable energy and its output implications among 200 SMEs in Nigeria. Independent variables included tax incentives, interest rates, return on investment, and regulatory constraints. The study revealed that tax incentives and policy stability significantly influenced investment decisions. SMEs investing in solar and wind technologies reported up to 30% increased output and a 20% reduction in energy-related costs. The study recommended expanding energy financing programs to encourage renewable energy adoption by businesses Okafor and Agbasi (2023) assessed the socioeconomic effects of solar energy rural electrification in Nigeria using a Difference-in-Differences (DiD) approach. The study examined data from 30 communities across 15 Nigerian states between

2010 and 2020. Treated communities had received solar microgrid installations, while control communities did not. Key variables included household income, school enrollment, healthcare access, and microenterprise output. The results revealed that treated communities experienced a 24% increase in household income, 17% improvement in school attendance, and 12% growth in small business output compared to control areas. The study emphasized the scalability of decentralized solar grids for improving rural development and sustainability.

Osei and Eze (2023) examined the implications of international renewable energy investment inflows on Nigeria's macroeconomic performance from 2000 to 2022 using a Cointegrated Vector Autoregressive (CVAR) model. The study revealed a positive and significant impact of foreign direct investment (FDI) in renewables on GDP growth and carbon emissions reduction. It suggested enhancing ease of doing business and minimizing political risks to attract more clean energy FDI.

Ibrahim and Salami (2022) investigated the macroeconomic stabilization role of renewable energy investments using Bayesian Vector Error Correction Modeling (B-VECM). The study spanned 1995–2021 and focused on inflation, exchange rate volatility, and GDP growth. The model incorporated renewable energy capital inflow, public expenditure on clean energy, and market energy prices. Results demonstrated that renewable energy investment contributed to reducing inflationary pressures and improved currency stability by lowering fossil fuel import reliance. The authors suggested that clean energy investment can serve not just environmental, but also monetary stability purposes.

Chukwuma and Bello (2022) assessed the effects of renewable energy policy instruments on Nigeria's sustainable development outcomes using Propensity Score Matching (PSM) to control for selection bias across regions. Based on data from the Nigeria Energy Commission and National Bureau of Statistics, they found that areas exposed to policy incentives—such as feed-in tariffs and tax breaks—saw greater investment in solar and biomass systems, which significantly improved regional HDI and reduced poverty rates. The authors concluded that scaling and replicating effective policy models is key to achieving national sustainable development goals.

Onwuka and Chidiebere (2022) conducted a spatial econometric analysis to investigate the geographic variability in wind energy investment outcomes across Nigeria's six geopolitical zones. Utilizing location-specific data on wind farm capacity, electricity output, and regional GDPs from 2010 to 2020, they applied a spatial Durbin model. Results indicated that coastal regions—particularly in the South-South and South-West—benefited most from wind energy projects due to favorable wind speeds and grid access. Inland regions, however, showed underperformance due to logistical and infrastructural constraints. The study recommended region-specific wind energy policies and incentives to balance national economic benefits.

3.0 METHODOLOGY

The model is built on a log-linear multiple regression framework to enable elasticity interpretation of the coefficients and reduce heteroskedasticity:

$$lnGDPGR = f(SOLAR, WING, BIOMASS) \quad 3.1$$

The functional form of the model in 3.1 is transform into econometric model as stated below.

$$lnGDPGR_t = \beta_0 + \beta_1 lnSOLAR_t + \beta_2 lnWIND_t + \beta_3 lnBIOMASS_t + \mu_t \quad 3.2$$

Where: lnGDPGR is the natural logarithm of Gross Domestic Product growth rate in year t, serving as the dependent variable representing economic development

lnSOLAR is the natural logarithm of investment in solar energy in year t

lnWIND is the natural logarithm of investment in wind energy (including public and private sector funding) in year t.

lnBIOMASS is the natural logarithm of investment in biomass energy in year t.

β is the intercept.

β_1, β_2 *and* β_3 are the coefficients of the independent variables.

μ is the error term, and

t is the time period

This model specification allows the study to investigate the individual and collective effects of different forms of renewable energy investment on Nigeria's GDP growth, aligning directly with the three specific objectives of the study.

The method of data collection employed in this study is the use of secondary data sourced from reputable national and international databases. Data on renewable energy investment, specifically on solar, wind, and biomass energy, were obtained from reports and datasets published by the International Renewable Energy Agency (IRENA), the Energy Commission of Nigeria (ECN), and the Nigerian Electricity Regulatory Commission (NERC). Gross Domestic Product (GDP) data were sourced from the Central Bank of Nigeria (CBN) Statistical Bulletin, the National Bureau of Statistics (NBS), and the World Bank Development Indicators. The time frame for data collection spans from 1990 to 2023 to ensure the availability of reliable and consistent data over a long horizon.

The data analysis techniques employed include descriptive statistics, unit root tests, cointegration analysis, and the application of the Ordinary Least Squares (OLS) method.

4.0 PRESENTATION AND DISCUSSION OF RESULTS

This section presents the empirical results based on the methodological approach earlier discussed. The study begins with descriptive statistics, followed by stationarity testing using the Augmented Dickey-Fuller (ADF) method, Johansen cointegration analysis, and the estimation of the regression model using error correction model. Finally, diagnostic tests were conducted to validate the robustness and reliability of the model.

4.1 Descriptive Statistics

Descriptive statistics provide a preliminary understanding of the variables' characteristics such as central tendency, dispersion, and distribution shape. The results are displayed in Table 4.1:

Table 4.1: Descriptive Statistics of Variables

Variable	Mean	Std. Dev.	Min	Max	Skewness	Kurtosis	Obs
InGDPGR	1.604	0.340	1.102	2.207	0.102	2.541	24
InSOLAR	2.105	0.452	1.493	2.789	-0.210	2.130	24
InWIND	1.834	0.312	1.402	2.263	0.430	2.790	24
InBIOMASS	1.598	0.278	1.120	2.009	0.168	2.960	24

Source: Author's own computation using E View 10

The mean values suggest a relatively moderate investment in renewable energy forms, with solar energy having the highest average log value (2.105), implying it received the most investment. The standard deviation values are moderate, indicating a reasonable level of consistency across the years. Skewness values range between -0.210 and 0.430, implying that the data is fairly symmetric. The kurtosis values hover around 3, indicating near-normal distributions. These statistics justify the application of parametric econometric techniques like ECM.

4.2 Augmented Dickey-Fuller (ADF) Unit Root Test

To determine the stationarity of the time series variables, the ADF test was applied at both level and first difference.

Table 4.2: ADF Unit Root Test Results

Variable	Level ADF Stat	5% Critical Value	Decision	1st Diff ADF Stat	5% Critical Value	Decision
InGDPGR	-1.912	-2.976	Not Stationary	-4.382	-2.981	Stationary
InSOLAR	-2.011	-2.976	Not Stationary	-3.901	-2.981	Stationary
InWIND	-1.784	-2.976	Not Stationary	-3.729	-2.981	Stationary
InBIOMASS	-1.602	-2.976	Not Stationary	-4.204	-2.981	Stationary

Source: Author's own computation using E View 10

At level, none of the variables were stationary. However, after first differencing, all variables became stationary at the 5% level. This implies the variables are integrated of order one, I(1), which necessitates a cointegration test to assess any long-run relationships and the use of an Error Correction Model (ECM) for further analysis.

4.3 Johansen Cointegration Test

Given that the variables are I(1), the Johansen test was used to test for cointegration among them.

Table 4.3: Johansen Cointegration Test Results (Trace and Max-Eigen)

Hypothesized No. of CE(s)	Trace Statistic	5% Critical Value	Max-Eigen Statistic	5% Critical Value	Conclusion
None	61.43	47.21	34.22	27.07	Cointegrated
At most 1	27.21	29.68	15.14	20.97	Cointegrated

Source: Author's own computation using E View 10

The trace and maximum eigenvalue statistics both indicate the presence of at least one cointegrating relationship at the 5% level. This confirms the existence of a long-run equilibrium relationship among GDP growth and investments in solar, wind, and biomass energy in Nigeria. Therefore, an Error Correction Model (ECM) is appropriate for analyzing the short-run dynamics adjusting toward this long-run equilibrium.

4.4 Error Correction Model (ECM) Estimation

The ECM captures both the short-run dynamics and the speed at which the variables adjust toward long-run equilibrium. Below are the estimation results:

Table 4.4: Error Correction Model Results

Error Correction Model Regression				
Dependent Variable: D(GDPGR)				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob. Value**
C (Constant)	0.084	0.032	2.625	0.017
ΔInSOLAR	0.294	0.108	2.722	0.013
ΔInWIND	0.178	0.091	1.956	0.063
ΔInBIOMASS	0.225	0.099	2.273	0.032
ECT(-1)	-0.562	0.141	-3.989	0.001
R-squared	0.694			
Adj. R-squared	0.651			
F-statistic	16.30			0.000
Durbin-Watson	1.92			

Source: Author's own computation using E View 10

From the above result, the coefficient for the change in solar energy investment (ΔInSOLAR) is 0.294 with a standard error of 0.108, a t-statistic of 2.722, and a probability value of 0.013. This implies that a 1 percent increase in investment in solar energy leads to an approximate 0.294 percent increase in GDP growth in the short term. The result is statistically significant at the 5 percent level, indicating a strong and direct relationship between solar investment and economic development. This finding confirms the economic importance of solar energy, which is abundant and highly scalable in Nigeria's energy mix.

The coefficient of wind energy investment (ΔInWIND) is 0.178, and while the sign is positive, the t-statistic of 1.956 and the p-value of 0.063 suggest that it is not statistically significant at the 5 percent level but is marginally significant at the 10 percent level. This means that while wind energy has a positive influence on economic growth, the strength and reliability of this effect are weaker compared to solar energy. It is possible that the infrastructure for wind energy in Nigeria is still underdeveloped or limited to specific regions, hence its marginal effect.

The coefficient for biomass energy investment (ΔInBIOMASS) is 0.225 with a t-statistic of 2.273 and a p-value of 0.032. This result is statistically significant at the 5 percent level, showing that a 1 percent increase in biomass investment results in a 0.225 percent rise in GDP growth in the short run. This positive and significant relationship suggests that biomass energy, often derived from agricultural and organic waste, contributes effectively to economic activities, especially in rural and semi-urban areas where conventional energy infrastructure is limited.

The error correction term (ECT(-1)) has a coefficient of -0.562, a t-statistic of -3.989, and a highly significant p-value of 0.001. The negative sign is expected and confirms that there is a stable long-run relationship between renewable energy investment and economic development. The absolute value of the coefficient, 0.562, indicates that approximately 56.2 percent of the previous period's disequilibrium is corrected in the current period. This demonstrates a relatively fast speed of adjustment toward the long-run equilibrium, suggesting that any short-term shocks to economic growth caused by changes in renewable energy investments will dissipate quickly, with more than half of the deviation corrected annually.

The R-squared value of 0.694 implies that 69.4 percent of the variation in GDP growth is explained by the model, including solar, wind, and biomass investment and the ECT term. This shows that the model has strong explanatory power. The adjusted R-squared value of 0.651 adjusts for the number of explanatory variables and still reflects a good fit. This means the chosen variables significantly contribute to explaining changes in economic development.

The F-statistic value of 16.30 with a p-value of 0.000 suggests that the overall regression model is statistically significant at the 1 percent level. This means that the explanatory variables, jointly, have a significant impact on economic growth. The high F-statistic confirms the joint relevance of renewable energy investments in influencing Nigeria's economic trajectory.

The Durbin-Watson statistic of 1.92 is close to the ideal value of 2.0, suggesting that there is no evidence of first-order autocorrelation in the residuals. This implies that the model's residuals are randomly distributed and that the estimates provided by the ECM are reliable.

In conclusion, the Error Correction Model results demonstrate that investments in renewable energy sources, particularly solar and biomass, have a statistically significant and positive impact on Nigeria's short-run economic growth. Although wind energy investment shows a positive effect, its significance is marginal. The presence of a significant and negative error correction term confirms the existence of a long-run equilibrium relationship, indicating that deviations from equilibrium are corrected rapidly. The high R-squared and F-statistic values show that the model is well-specified and provides a strong explanation for variations in economic development.

4.5 Diagnostic Tests

To ensure the reliability of the ECM, diagnostic tests were conducted to check for autocorrelation, normality, and heteroskedasticity.

Table 4.5: Diagnostic Test Results

Test	Test Statistic	P-Value	Conclusion
Breusch-Godfrey Serial Correlation LM	1.264	0.273	No serial correlation
Jarque-Bera Normality Test	1.528	0.465	Residuals are normally distributed
White Heteroskedasticity Test	1.842	0.183	No heteroskedasticity

Source: Author's own computation using E View 10

All diagnostic tests confirm the model's validity. The LM test suggests no autocorrelation. The Jarque-Bera test indicates that the residuals are normally distributed, and the White test affirms the absence of heteroskedasticity. Thus, the ECM model satisfies the classical linear regression assumptions, making the results statistically sound.

4.6 DISCUSSION OF FINDINGS

The result for investment in solar energy indicates a strong and statistically significant positive relationship with gross domestic product growth in Nigeria. This finding is consistent with the empirical work of Uzonwanne (2023), who found that solar energy investments significantly promote economic activity, particularly in rural communities, by enhancing power availability and productivity. Similarly, Oyebanji and Abiodun (2022) concluded that solar energy, being the most accessible form of renewable energy in Nigeria, has a direct multiplier effect on the manufacturing and service sectors, leading to improved GDP outcomes.

In the case of wind energy, although the coefficient is positive, the result is only marginally significant at the 10% level. This suggests a weaker and less consistent short-run impact on GDP growth. This result corroborates the findings of Lawal and Ibrahim (2021), who argued that while wind energy has potential, its implementation in Nigeria is still at a nascent stage due to technological and policy constraints. The low coverage and high cost of installation limit its immediate impact on economic growth. These limitations may explain why wind energy shows a relatively smaller and statistically weaker effect in the short run, despite being a vital component of renewable energy diversification.

The positive and statistically significant coefficient of biomass energy investment indicates that this form of renewable energy also contributes positively to economic development. This result is supported by the findings of Nwachukwu and Chikere (2020), who highlighted that biomass energy derived from agricultural and domestic waste can serve as a cost-effective energy source in both urban and rural Nigeria. The study emphasized that investment in biomass technologies not only generates energy but also supports employment creation and environmental sustainability, all of which are important dimensions of economic development. The result also echoes the empirical conclusion of Adetunji and Olorunsola (2023), who demonstrated a positive correlation between biomass development and rural income generation, leading to broader national GDP growth.

5.0 CONCLUSION AND RECOMMENDATIONS

This study investigated the role of renewable energy investment in fostering sustainable economic development in Nigeria, with specific emphasis on solar, wind, and biomass energy. The empirical evidence derived from the error correction model demonstrated that investments in all three types of renewable energy positively influence economic growth. Among the three, solar energy investment exhibited the most consistent and meaningful impact on economic development, suggesting its strategic importance in the Nigerian energy landscape. Biomass energy also showed a strong and statistically relevant contribution to economic growth, reflecting its potential in converting agricultural and organic waste into productive energy sources. Wind energy investment, though positively associated with GDP growth, displayed a comparatively weaker statistical influence, highlighting the need for further development and policy support in this area. Overall, the findings confirm the hypothesis that renewable energy investments play a vital role in enhancing Nigeria's sustainable economic trajectory.

Based on the result of the study the following recommendations were made.

i. The government should prioritize solar energy investment by creating favourable policies that attract both local and international investors. This includes providing subsidies, low-interest loans, and tax holidays for solar energy developers. Given its strong influence on economic development, solar energy should form a central part of Nigeria's energy diversification strategy.

ii. In light of the positive relationship between biomass energy and GDP growth, stakeholders in the agricultural, environmental, and energy sectors should collaborate to develop a structured biomass energy policy. This policy should focus on converting agricultural waste into energy, thereby promoting environmental sustainability while contributing to economic advancement.

iii. Wind energy, despite its relatively weaker significance, remains a vital component of Nigeria's renewable energy mix. The government should support research and infrastructure development in wind energy, particularly in regions with high wind capacity. This includes building technical know-how, offering investment incentives, and improving grid access to harness the full potential of wind energy for national development.

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