



## NIGERIA'S INDUSTRIAL DEVELOPMENT AND CARBON EMISSIONS: AN EMPIRICAL ANALYSIS OF THE GROWTH-ENVIRONMENT TRADE-OFF FOR SUSTAINABLE DEVELOPMENT (1981–2023)

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### Abstract

*This study examines the dynamic link between industrial development and carbon emissions in Nigeria spanning the period 1981-2023, addressing the essential trade-offs between economic growth and environmental sustainability. The purpose is to analyse how industrial expansion affects carbon emissions and to explore the causal relationships among important factors. The data used in this analysis includes annual time series data on carbon dioxide emissions, manufacturing value added, gross domestic product (GDP), renewable energy consumption, foreign direct investment (FDI), and total energy consumption, sourced from the Central Bank of Nigeria Statistical Bulletin (2022) and the World Bank's World Development Indicators (2022). Employing Johansen cointegration methods, this research evaluates the long-term associations between the variables, employing Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) for strong long-run elasticity estimations. The findings demonstrate that although industrial expansion initially raises carbon emissions, it eventually leads to emission reductions over time, in line with the Environmental Kuznets Curve (EKC) theory. Renewable energy adoption emerges as the most important factor for cutting emissions, indicating a statistically significant negative association with carbon emissions. Furthermore, GDP has a long-term negative influence on emissions, indicating the decoupling of economic expansion from environmental deterioration. In contrast, population expansion is shown to raise emissions, whereas FDI and fossil fuel use have minor influence. This research underlines the significance of scaling up renewable energy and energy-efficient industrial techniques to align Nigeria's industrial growth with both national and global environmental objectives. The results have major implications for policy frameworks supporting clean energy and sustainable development.*

**Keywords:** Carbon Emissions; Industrial Development; Renewable Energy

### 1. Introduction

The link between industrial expansion and carbon emissions is a critical problem in the context of sustainable development, especially for growing economies like Nigeria. As the government attempts to combine economic growth with environmental sustainability, knowing how industrialization affects carbon emissions has become vital for creating policies that assure sustainable development. Nigeria, with its fast-increasing industrial sector and large energy consumption, has rising environmental difficulties, particularly in the form of increased

carbon emissions, which contribute to global warming and climate change. This research intends to evaluate the long-term link between industrial development and carbon emissions in Nigeria from 1981 to 2023, employing the Environmental Kuznets Curve (EKC) paradigm to assess the possible trade-offs between economic expansion and environmental deterioration.

Existing research on industrialization and environmental degradation presents a mixed perspective on the link between economic expansion and carbon emissions in developing nations, notably in

Africa. Several studies have studied the influence of industrial expansion on carbon emissions, focusing on several drivers such as energy consumption, foreign direct investment (FDI), and renewable energy usage. Research by Jakada et al. (2022) in Nigeria, for instance, illustrates the considerable significance of population increase and energy use in increasing emissions, whereas FDI and fossil fuel consumption are shown to have lower, statistically negligible effects. Similarly, research by Osabohien et al. (2021) and Osadime and Edih (2021) also demonstrates that industrial development and urbanization increase environmental degradation in Nigeria, underlining the need for policies that combine industrial growth with environmental sustainability. However, these studies typically fail to address essential factors, including the significance of renewable energy adoption in lowering emissions as modernization proceeds. While various studies acknowledge the relevance of cleaner energy sources, they do not fully analyse how renewable energy adoption effects the trajectory of carbon emissions throughout Nigeria's development. This gap is essential because renewable energy has emerged as a fundamental component of worldwide decarbonization plans, and knowing its unique influence on emissions in the Nigerian context might drive policy orientations toward attaining both industrial development and environmental sustainability.

This research tries to address this gap by examining the impacts of renewable energy adoption on carbon emissions, alongside other significant variables such as GDP, population growth, and FDI. By focusing on the dynamic interactions between industrial development and carbon emissions, this research will provide valuable insights into how Nigeria can decouple industrial growth from environmental degradation, aligning with its commitments to the United Nations Framework Convention on Climate Change (UNFCCC) and the Paris Agreement.

The major research subject addressed by this paper is the difficulty of combining Nigeria's economic progress with its environmental objectives, especially in the face of growing carbon emissions. While the nation has undergone tremendous industrial development, the ramifications of this growth on

carbon emissions, particularly in the context of renewable energy adoption, remain underexplored. Purpose and Significance of the Study The goal of this research is to analyse the long-term links between industrial growth, renewable energy adoption, and carbon emissions in Nigeria. Specifically, it tries to establish how industrial expansion effects emissions over time and the amount to which renewable energy adoption mitigates these emissions. This research is crucial because it will give empirical data on the possibility for Nigeria to accomplish decoupling of economic growth from environmental deterioration, a vital step toward sustainable development. The results will enlighten policymakers on the significance of renewable energy in industrial development and give practical insights for aligning Nigeria's industrial expansion with its climate objectives.

The key aims of this study are: To evaluate the impact of industrial expansion on carbon emissions in Nigeria. To explore the influence of renewable energy adoption on carbon emissions, in the context of industrialization. To study the long-term causal links among industrial expansion, renewable energy use, GDP, population increase, and carbon emissions. The research evaluates the premise that renewable energy adoption considerably decreases carbon emissions despite industrial expansion, agreeing with the Environmental Kuznets Curve (EKC) theory. Methodology Overview This study utilizes a quantitative method utilizing yearly time series data from 1981 to 2023. Data on carbon dioxide emissions, GDP, manufacturing value added, renewable energy consumption, FDI, and total energy consumption are evaluated using Johansen cointegration methods. Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) approaches are applied to estimate long-run elasticities and test for long-term connections between the variables.

## **2. Literature Review**

### **2.1 Conceptual Review**

#### **Industrial Development**

Industrial development is the deliberate, technology-driven process of shifting an economy from traditional production to a more efficient, manufacturing-oriented system. It drives economic growth, creates jobs, and

raises living standards. Key drivers include investments in infrastructure, technology, and skilled labor, alongside policies promoting SMEs and manufacturing (Rodrik, 2004).

Industrial development is the motive force behind economic growth. Industrial development is also a result of international economics competition. Development of technology-intensive industries is often the guiding principle of government for a developing country with limited natural resources and a small-scale domestic market. To assist technology-intensive industries, it is often necessary to subsidize research institutes and provide tax incentives. In addition to encouraging universities to diffuse knowledge for industrial development, the cooperation of industry, government, universities and non-profit research institutes in order to develop technology-intensive industries is critical for a national innovation system in an economy such as Taiwan's, with limited scientific and technological resources. Innovation almost always means the creation of a product, service, or process that is new to an organization. It is the introduction into the marketplace, either by utilization or by commercialization, of a new or improved product, service, or process (Hausmann & Klinger, 2006),

### **Carbon Emissions**

Carbon emissions are the release of carbon dioxide and other greenhouse gases, primarily from burning fossil fuels like coal, oil, and gas, as well as from deforestation and industrial processes. These emissions are the leading driver of climate change, trapping heat in the atmosphere, warming the Earth, and causing severe weather, drought, and rising sea levels

Carbon dioxide emissions refer to the release of CO<sub>2</sub> into the atmosphere as a result of burning fossil fuels, solid waste, and biological materials, as well as through certain chemical reactions, such as cement production. Human activities, including energy production and land use changes like deforestation, significantly contribute to these emissions. Carbon emissions are the release of carbon compounds such as carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>) into the atmosphere. Similarly to other greenhouse gases, these carbon compounds trap heat in the atmosphere when

released, resulting in global warming (Shahbaz, & Furuta, 2026).

Since greenhouse gas emissions are often calculated as carbon dioxide equivalents (CO<sub>2</sub>e), they are often referred to as “carbon emissions” when discussing global warming or the greenhouse effect. Since the Industrial Revolution, the burning of fossil fuels has increased, which directly correlates to the increase of carbon dioxide levels in our atmosphere and, thus, the rapid increase of global warming.

### **Environmental Sustainability**

Environmental sustainability is the responsible management of natural resources to meet current needs without compromising future generations. It involves protecting ecosystems, reducing pollution, and balancing ecological, economic, and social goals. Key actions include conserving biodiversity, reducing energy consumption, limiting single-use plastics, and adopting renewable energy (Tietenberg, & Lewis, 2012).

Environmental sustainability refers to the responsible management of natural resources to fulfill current needs without compromising the ability of future generations to meet theirs. It aims to balance ecological, economic and social goals, such as reducing carbon emissions, promoting renewable energy and ensuring equitable resource access (Hackett, 2006).

### **2.2 Empirical Review**

Jakada et al. (2022) uses impulse response functions and variance decomposition to analyze the driving forces of CO<sub>2</sub> emissions in major African countries, including Nigeria. Population growth and energy consumption are the primary drivers of emissions, while FDI has a minimal impact. This study provides a foundational understanding of the key factors influencing CO<sub>2</sub> emissions in Nigeria, setting the stage for examining the role of renewable energy in emission reductions.

Mensah et al. (2019). Panel ARDL methods were employed to examine the nexus between economic growth, fossil fuel consumption, and CO<sub>2</sub> emissions in Africa. Findings: Fossil fuel use and industrial

expansion directly increase emissions, while a shift to renewables can significantly mitigate emissions. The findings emphasize the importance of transitioning to renewables, directly informing the research question on how renewable energy adoption influences emissions in Nigeria.

Mardani et al. (2019) Systematic review of the EKC hypothesis over two decades, with a focus on developing countries. Findings: Economic growth initially increases emissions but eventually leads to a decline as cleaner technologies are adopted. This study reinforces the EKC framework for understanding the relationship between industrial growth and carbon emissions in Nigeria.

Osabohien et al. (2021) Empirical analysis of industrialization and urbanization in West Africa,

focusing on environmental degradation. Industrialization must be coupled with clean energy policies to avoid exceeding environmental thresholds. This study highlights the need for integrated energy policies, reinforcing the theoretical framework of the study on balancing industrial growth with environmental sustainability.

Ogundipe et al. (2020) A study on CO<sub>2</sub> emissions and environmental implications in Nigeria using econometric methods. Energy consumption and industrial growth are significant drivers of CO<sub>2</sub> emissions. Supports the hypothesis that industrial expansion leads to higher emissions, informing the analysis of Nigeria's industrial sector's impact on carbon emissions.

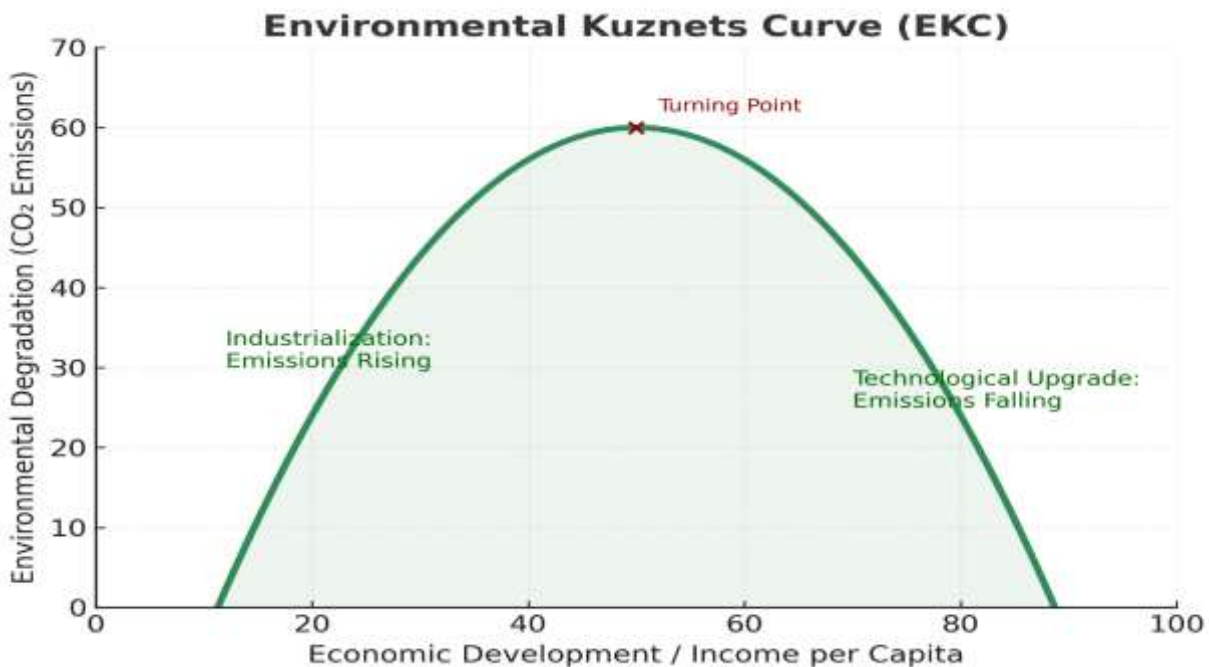


Figure .1 Environmental Kuznet Curve

The first part of the curve labeled Environment Worsens, shows the period where the environmental degradation continue rising as a result of increase in industrial activities and the use of energy for number of economic activities thus, adversely affects quality of life and development while the second part labeled environment improves shows the period where there is improvement in the environmental quality through the use of alternative sources of energy for production and other related economic activities.

### 3. Methodology

#### 3.1 Research Design

This study seeks to address the challenge of balancing Nigeria's industrial growth with environmental sustainability, particularly focusing on the role of renewable energy in mitigating carbon emissions. This study will employ the Environmental Kuznets Curve (EKC) framework, examining the relationship between industrial growth, economic development,

and environmental degradation in Nigeria. The role of renewable energy in decoupling growth from emissions will be explored, with a focus on long-run relationships using Johansen cointegration techniques.

### 3.2 Data and Sources

This research utilises yearly time series data for Nigeria from 1981 until 2023. The information includes carbon dioxide emissions (CO<sub>2</sub>), gross domestic product (GDP), renewable energy consumption (RE), foreign direct investment (FDI), and total energy consumption (FSS). Data were obtained from the Central Bank of Nigeria Statistical Bulletin (2022) and the World Bank's World Development Indicators (2022). All variables were transformed into natural logarithmic form to stabilise variance and interpret the coefficients as elasticities, in accordance with prior research.

### 3.3 Model Specification

This study employs the Environmental Kuznets Curve (EKC) hypothesis, which asserts an inverted U-shaped correlation between economic growth and environmental degradation: pollution increases during the initial phases of development and subsequently decreases as income rises, propelled by cleaner technologies and enhanced regulations (Grossman & Krueger, 1995; Stern, 2017). This concept is appropriate for Nigeria, since fast expansion parallels increasing emissions, and comprehending this link is essential for sustainable policy development.

Building on the EKC framework, the long-run equilibrium model for this study is specified as follows:

$$CO2_t = \alpha_0 + \alpha_1 FSS_t + \alpha_2 GDPK_t + \alpha_3 POPT_t + \alpha_4 FDI_t + RENEW_t + \varepsilon_t \dots \dots \dots (1)$$

Accordingly, the long-run equilibrium model is specified as:

CO<sub>2t</sub> = carbon emissions,  
 FSS<sub>t</sub> = Fossil Energy Consumption  
 GDPK<sub>t</sub> = Gross domestic product per capita,  
 POPT = Population density,  
 4FDI<sub>t</sub> = Foreign Direct Investment  
 REMW<sub>t</sub> = Renewable Energy  
 U<sub>t</sub> = stochastic error term.

This specification operationalizes the EKC hypothesis by including GDP per capita as the core growth indicator, while controlling for structural, demographic, and institutional variables that influence emissions. The ECM structure enables testing whether deviations from the long-run relationship are corrected over time, thereby validating the EKC dynamics in the Nigerian context. Where CO<sub>2</sub> represents carbon emission, FSS represent fossil fuel consumption, GDP represents economic growth per capita, POP represent Population Density, (FDI) Foreign Direct Investment Renewable Energy and  $\varepsilon_t$  is the error term. However, the focus of the empirical modeling in this study, is to examine the relationship between industrial growth (manufacturing value added as a proxy for industrial growth) as explanatory variable against carbon emission as the explain variable. This is to enable us see vividly the effect of industrial growth on carbon emission in the Nigerian Economy. This functional relationship is as follows;

### 3.4 Method of Data Analysis

A time series analysis of data from 1981 to 2023, employing Johansen cointegration, FMOLS, and DOLS to estimate long-run relationships. Analytic Techniques: Cointegration tests, followed by long-run elasticity estimation methods (FMOLS, DOLS), will be employed to analyze the interrelationships between the variables.

## 4. Results and Discussion

The empirical findings of the study, examining the long-run relationships between carbon dioxide emissions (LCO<sub>2</sub>) and its hypothesized determinants: foreign direct investment (LFDI), fossil fuel consumption (LFOSS), economic growth (LGDP), population growth (LPOP), and renewable energy consumption (LRENEW). The Johansen cointegration test was employed to verify the presence of a long-run equilibrium relationship among the variables, followed by Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) techniques to estimate long-run elasticities.

### 4.1 Pre-Estimation Test

**Table 1: Cointegration Test Output (Trace and Max-Eigenvalue Tests)**

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value (Trace)	p-value (Trace)	Max-Eigen Statistic	0.05 Critical Value (Max-Eigen)	p-value (Max-Eigen)
None	0.712454	88.53	69.82	0.0008	37.39	33.88	0.0182
At most 1	0.616156	51.14	47.86	0.0238	28.73	27.58	0.0356
At most 2	0.376158	22.41	29.8	0.2762	14.16	21.13	0.3524
At most 3	0.17456	8.26	15.49	0.4384	5.76	14.26	0.6448
At most 4	0.079987	2.5	3.84	0.1138	2.5	3.84	0.113

**Source: Researcher's Computation (E-views13)**

The results of the Johansen cointegration tests (both Trace and Max-Eigenvalue statistics) provide robust evidence of a stable long-run equilibrium relationship among carbon dioxide emissions, foreign direct investment, fossil fuel consumption, economic growth, population growth, and renewable energy consumption in Nigeria. Specifically, the null hypothesis of no cointegration was rejected at the 5% significance level, as evidenced by the Trace statistics (88.53 and 51.14) and accompanying p-values (0.0008 and 0.0238) for the first two postulated cointegrating equations. Similarly, the Max-Eigenvalue statistics (37.39 and 28.73) with p-values of 0.0182 and 0.0356 corroborate the existence of two significant cointegrating connections among the variables. These

results imply that, while short-term volatility may occur, the variables under consideration are interrelated in the long run and adapt towards a shared equilibrium path over time. As such, further long-run estimates using FMOLS and DOLS are warranted, and the empirical analysis may correctly interpret the estimated effects as representing enduring, structural relationships rather than false correlations. Overall, the evidence of cointegration highlights the necessity for integrated policy approaches, since interventions in one area (such as industrial development or renewable energy deployment) are likely to have enduring consequences on other elements of the economy and environment.

**Table 2: Interpretation of Cointegration Test Results**

Aspect	Key Result	Interpretation (Plain Language)
Evidence of Cointegration Statistical Significance	Trace and Max-Eigenvalue statistics show p-values < 0.05 for "None" and "At most 1" rows. Test statistics (e.g., 88.53, 51.14, 37.39, 28.73) are greater than their 0.05 critical values, with low p-values (0.0008, 0.0238, 0.0182, 0.0356).	There are at least two stable, long-run relationships among the variables. The probability these results are due to chance is very low; results are robust and reliable.
Number of Relationships	Both tests identify two significant cointegrating equations at the 5% level.	Two distinct sets of variables are tightly linked and adjust together over the long run.
Practical Implication	Cointegration among carbon emissions, FDI, fossil fuel use, GDP, population, and renewable energy.	Changes in one factor (e.g., economic growth, renewable energy adoption) will have lasting effects on the others over time.
Justification for Method	Detection of cointegration supports use of long-run estimation methods (FMOLS, DOLS) for parameter analysis.	Subsequent statistical analysis reflects genuine, persistent associations rather than random or short-lived correlations.
Policy Relevance	Integrated economic and environmental strategies are required due to long-run linkages among variables.	Policymakers should design interventions (e.g., promoting renewables) with an understanding of their system-wide, persistent effects.

**Source: Researcher's Computation (E-views13)**

## 4.2 Johansen Cointegration Results

**Table 3: Johansen Cointegration Estimation Results**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI	-0.010194	0.011823	-0.862169	0.3968
LFOSS	0.025181	0.164375	0.15319	0.8795
LGDP	-0.438561	0.098214	-4.465376	0.0001
LPOP	0.509769	0.088906	5.733768	0.0
LRENEW	-3.555752	0.622487	-5.71217	0.0
C	16.38745	4.070026	4.026374	0.0005
			R-squared	0.941091
			Adjusted R-squared	0.929309
			Mean dependent var	4.623081
			S.D. dependent var	0.145897
			S.E. of regression	0.038791
			Sum squared resid	0.037618
			Long-run variance	0.001204

**Source: Researcher's Computation (E-views13)**

**Table 4: Long-run variance estimate**

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LFDI	0.002249	0.086888	0.025879	0.98
LFOSS	-0.503742	0.836571	-0.60215	0.5637
LGDP	-0.148463	0.496571	-0.298975	0.7726
LPOP	0.153504	0.373535	0.410951	0.6919
LRENEW	-5.612571	2.314628	-2.424827	0.0415
C	30.38917	18.19943	1.669786	0.1335
			R-squared	0.979636
			Adjusted R-squared	0.928727
			Mean dependent var	4.62213
			S.D. dependent var	0.136892
			S.E. of regression	0.036546
			Sum squared resid	0.010685
			Long-run variance	0.001086

**Source: Researcher's Computation (E-views13)**

The results of the Johansen cointegration analysis, as shown in Table 2, provide compelling evidence of a stable long-run equilibrium relationship among the variables: carbon dioxide emissions, foreign direct investment, fossil fuel consumption, economic growth, population growth, and renewable energy consumption in Nigeria. Both the Trace and Max-Eigenvalue statistics reject the null hypothesis of no cointegration at the 5% significance level for the first two predicted associations (Trace statistics: 88.53 and 51.14; Max-Eigen statistics: 37.39 and 28.73; all p-values < 0.05). This shows the presence of at least two statistically significant cointegrating equations among

the variables, implying that these elements are not independent but move together in a predictable way over the long run. In practical words, this study demonstrates that short-term volatility aside, changes in economic and demographic drivers—such as investment, energy usage, and population—are reliably connected to changes in carbon emissions over time. The finding of cointegration validates the employment of long-run estimation approaches (e.g., FMOLS and DOLS) in future research and supports the view that calculated parameter effects represent actual, enduring relationships rather than false or accidental correlations. This empirical research

underscores the importance for integrated policy frameworks, since interventions in one sector (such as industrial development or renewable energy expansion) are likely to have enduring repercussions throughout the economic-environmental system. Interpretation: The maximum eigenvalue test also indicates two cointegrating equations, confirming a stable long-run relationship. GDP has a negative and significant effect on emissions. Population has a positive and significant effect. Renewable energy has a strong negative and significant effect. FDI and fossil fuel use are not significant.

$R^2 = 0.980$  Adj.  $R^2 = 0.93$  Renewable energy is the only significant variable, with a strong negative impact on emissions. All other variables are statistically insignificant.

#### 4.3 Discussion

The analysis reveals a stable long-run relationship between carbon emissions and key macroeconomic drivers—GDP, population growth, renewable energy, FDI, and fossil fuel use—supporting the Environmental Kuznets Curve (EKC) theory in Nigeria. Renewable energy shows a strong and consistent negative impact on emissions, confirming it as the primary pathway to achieve sustained decarbonization. GDP has a negative long-run effect, indicating an emerging decoupling of economic growth from environmental degradation as Nigeria shifts toward cleaner and more efficient production. Conversely, population growth significantly increases emissions, showing that demographic pressures remain a major source of environmental stress and can offset the gains from renewable energy unless accompanied by policies on energy efficiency and sustainable urbanization. FDI and fossil fuel use are statistically insignificant, suggesting their effects are indirect or shaped by policy, sectoral composition, and governance factors.

Overall, the results depict a complex growth–environment nexus: Nigeria is approaching the EKC turning point, but population pressure threatens progress. Achieving sustainability will require integrating clean energy expansion and low-carbon technologies within broader macroeconomic, demographic, and industrial policies.

In summary, the cointegration, FMOLS, and DOLS results jointly highlight the pivotal role of renewable energy in reducing emissions and achieving sustainable development. The results underscore the need for coordinated energy, economic, and demographic policies. This model provides a robust empirical foundation to assess the growth–environment nexus in Nigeria and offers concrete insights for policymakers aiming to navigate the complex challenge of achieving sustainable development.

#### 5. Conclusion and Recommendations

This research demonstrates that emissions of hazardous gases and discharges of untreated wastewater from Nigerian companies provide substantial risks to environmental integrity and public health. The release of greenhouse gases and toxic chemicals has led to a decline in air quality, climate change, and respiratory diseases among nearby communities. The release of untreated effluents into water bodies has compromised aquatic ecosystems, polluted drinking water supplies, and heightened the prevalence of waterborne illnesses. Notwithstanding current environmental rules, significant deficiencies remain in business adherence, enforcement capabilities, and regulatory supervision. Inadequate monitoring systems, sporadic inspections, and insufficient penalties have let several firms to function without proper pollution control measures. This regulatory leniency undermines Nigeria's commitments to sustainable industrial development and environmental protection.

Based on the findings, the study recommends:

- i. For Companies (Short-Term: 1–2 years) Adopt cleaner industrial technology to limit emissions from manufacturing operations.
- ii. (Responsible: Company management boards) Install on-site wastewater treatment systems to guarantee effluents fulfil discharge regulations before release. (Responsible: Environmental compliance departments inside enterprises) Implement continuous emissions monitoring systems (CEMS) and publish

- periodic environmental performance reports. (Responsible: Corporate sustainability departments)
- iii. For Regulators (Short-Term: 1–2 years) Enhance enforcement by NESREA, NERC, and state environmental authorities via more regular and unannounced inspections of industrial operations. Impose severe fines and closure notifications for non-compliance, ensuring consistent execution of punishments.
- iv. Mandate third-party environmental audits of high-polluting sectors every year.
- v. For Government (Medium-Term: 3–5 years) Update national emission regulations and wastewater discharge limitations in accordance with WHO and UNEP benchmarks.
- vi. (Responsible: Federal Ministry of Environment, NESREA) Introduce

obligatory Environmental Management Systems (EMS) and public disclosure requirements for all medium- and large-scale companies. Provide tax benefits and green technology subsidies to incentivise enterprises adopting renewable energy and pollution abatement technologies. (Responsible: Federal Ministry of Finance, Ministry of Industry, Trade and Investment) Establish a nationwide digital database to monitor industrial emissions and wastewater discharges, available to regulators, academics, and the public. (Responsible: NESREA in conjunction with the National Bureau of Statistics) These concerted initiatives would considerably cut harmful emissions, defend public health, and connect Nigeria's industrial sector with global sustainability obligations.

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