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Balancing climate change mitigation and energy transition for sustainable economic growth in Nigeria: A literature review

Esther Nkiruka Ozuruoha [1, *], Ibekwe Ugochukwu Humphrey [2], Olabamibo Oluwafolakemi Olushola [3], Emmanuel Chinedu NWAJEI [4], Samuel Samuel Otikor [5] and Abdullahi Umar Nasiru [6]

[1] *Department of Mechanical Engineering, School of Engineering and Engineering Technology, Federal University of Technology, Owerri, Imo State, Nigeria.*
[2] *Department of Chemical Engineering, School of Engineering and Engineering Technology, Federal University of Technology, Owerri, Imo State, Nigeria.*
[3] *Department of Electrical and Electronics Engineering, faculty of Electrical and Information Engineering, Covenant University, Ota, Ogun State, Nigeria.*
[4] *Department of Chemistry, Faculty of Physical Sciences, University of Benin, Benin city, Edo State, Nigeria.*
[5] *Department of Mechanical Engineering, College of Engineering and Engineering Technology, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.*
[6] *Department of Economics, Faculty of Social and Management Sciences, Yobe State University, Damaturu, Yobe State, Nigeria.*

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Abstract

Climate change poses significant threats to Nigeria's economic growth, energy security, and environmental sustainability. At the same time, the country faces the challenge of transitioning from fossil fuel dependency to renewable energy to meet global climate commitments. This study provides a systematic literature review examining the interconnections between climate change mitigation, energy transition, and sustainable economic growth in Nigeria. The review draws on peer-reviewed articles, government reports, and international publications published between 2000 and 2024. Key findings indicate that climate change has an adverse impact on agriculture, energy production, public health, and infrastructure, imposing both direct and indirect economic costs. Conversely, Nigeria's abundant renewable energy resources solar, wind, biomass, and hydropower present significant opportunities for expanding energy access, driving industrial growth, creating green jobs, and reducing emissions. However, challenges such as policy inconsistency, financing gaps, technological constraints, institutional weaknesses, and social resistance impede a balanced transition. The study concludes that achieving sustainable economic growth alongside climate change mitigation requires coherent policies, robust institutional frameworks, financial innovation, technological capacity building, and inclusive social engagement. Policy recommendations emphasise harmonising energy and climate strategies, promoting renewable energy investments, and fostering a just transition to ensure environmental sustainability and long-term economic resilience.

Keywords: Climate change mitigation; Energy transition; Sustainable economic growth; Renewable energy; Nigeria; Policy frameworks

1. Introduction

Climate change has emerged as one of the most pressing global challenges of the 21st century, with profound implications for economic development, energy security, and environmental sustainability. Rising global temperatures,

* Corresponding author: Esther Nkiruka Ozuruoha

erratic rainfall patterns, desertification, and frequent flooding are affecting livelihoods, infrastructure, and food security, particularly in developing economies such as Nigeria (Intergovernmental Panel on Climate Change [IPCC], 2021). Nigeria, being Africa's most populous nation and largest economy, faces a unique dilemma: while heavily dependent on fossil fuels for revenue and foreign exchange earnings, it is also highly vulnerable to the adverse impacts of climate change (Akinbami, 2020; IEA, 2022).

The Nigerian economy relies significantly on oil and gas, which account for over 80% of government revenues and more than 90% of export earnings (Central Bank of Nigeria [CBN], 2022). This reliance on fossil fuels contradicts global climate change mitigation commitments, particularly the 2015 Paris Agreement, which underscores the necessity of reducing greenhouse gas (GHG) emissions and shifting to cleaner energy sources (United Nations Framework Convention on Climate Change [UNFCCC], 2015). Consequently, the nation has the dual problem of achieving sustainable economic growth while fulfilling international commitments about climate change mitigation.

Energy transition, which refers to the gradual shift from fossil fuels to renewable and cleaner energy sources, has become a critical policy issue in Nigeria. Renewable energy sources such as solar, wind, biomass, and hydropower have been identified as viable alternatives for diversifying the energy mix, enhancing energy access, and promoting environmental sustainability (Ohunakin et al., 2014; Oyedepo, 2021). However, the transition process is constrained by structural challenges, including inadequate infrastructure, policy inconsistency, financing gaps, and the socio-economic dependence of communities on fossil fuel-related activities (Osabuohien et al., 2020).

1.1. Statement of the Problem

Despite Nigeria's abundant renewable energy potential, the economy remains locked in a carbon-intensive growth pathway. Efforts to mitigate climate change often conflict with short-term economic and fiscal priorities. For instance, reducing fossil fuel use through the removal of subsidies and carbon pricing could generate fiscal space and reduce emissions. However, it may also trigger inflationary pressures, increase energy poverty, and exacerbate social unrest (Adewuyi & Awodumi, 2017). This raises the central policy question: how can Nigeria balance climate change mitigation with a just and inclusive energy transition that supports sustainable economic growth?

1.2. Objectives of the Study

The primary objective of this study is to investigate the interconnections between climate change mitigation, energy transition, and sustainable economic growth in Nigeria, drawing on insights from existing literature. The specific objectives are to:

- Explore the relationship between climate change and Nigeria's economic development.
- Assess the role of energy transition in mitigating climate change and driving sustainable growth.
- Identify the challenges and opportunities in achieving a balanced pathway between emission reduction and economic expansion.
- Review policy strategies and frameworks for a just and inclusive energy transition in Nigeria.

1.3. Research Questions

- How does climate change affect Nigeria's economic growth and development?
- What role can energy transition play in reducing emissions while sustaining economic growth?
- What challenges hinder Nigeria from achieving a balance between climate change mitigation and energy transition?
- What policy measures can ensure an inclusive and sustainable transition in Nigeria?

1.4. Significance of the Study

This study is significant in several respects. First, it contributes to the growing literature on climate change mitigation and energy transition in developing economies by focusing on Nigeria, a resource-dependent country with high vulnerability to climate change. Second, it offers policymakers insights into how to reconcile global environmental commitments with national development priorities. Third, the study highlights the socio-economic implications of energy transition, particularly in terms of employment, poverty reduction, and long-term sustainability (Okonkwo & Eze, 2022).

2. Literature Review

2.1. Conceptual Clarification

2.1.1. Climate Change Mitigation

Climate change mitigation refers to efforts aimed at reducing or preventing the emission of greenhouse gases (GHGs) into the atmosphere. This includes strategies such as transitioning to renewable energy, enhancing energy efficiency, adopting carbon capture technologies, and implementing sustainable land-use practices (IPCC, 2018). In Nigeria, mitigation efforts are increasingly aligned with national development priorities, such as the National Climate Change Policy (2012) and the Energy Transition Plan (2022), which aim to reduce carbon intensity while expanding energy access (NCCP, 2012; Federal Government of Nigeria, 2022).

2.1.2. Energy Transition

The energy transition is the process of shifting from a fossil fuel-dominated energy system to one based on low-carbon, renewable, and sustainable energy sources. It entails adopting technologies such as solar, wind, hydropower, and bioenergy, while phasing down coal, oil, and gas (Smil, 2017). For Nigeria, the transition is not only about environmental concerns but also about addressing chronic energy poverty, since over 85 million Nigerians lack access to reliable electricity (International Energy Agency [IEA], 2022).

2.1.3. Sustainable Economic Growth

Sustainable economic growth refers to a development path that ensures economic expansion without compromising environmental quality and social equity (World Bank, 2020). In Nigeria, sustainable growth involves balancing industrialisation, poverty reduction, and employment generation with environmental sustainability and resilience to climate change (Akinbami, 2020).

2.2. Theoretical Review

Several theories underpin the discourse on climate change, energy transition, and sustainable growth:

2.2.1. The Environmental Kuznets Curve (EKC) Hypothesis

The Environmental Kuznets Curve posits that environmental degradation rises with economic growth until a specific income level is attained, after which there is a demand for cleaner environments (Grossman & Krueger, 1995). This theory holds significant relevance for Nigeria, where rapid industrialisation and reliance on fossil fuels have resulted in heightened emissions, prompting enquiries into the potential for economic growth to foster more environmentally sustainable policies.

2.2.2. Sustainable Development Theory

Proposed by the Brundtland Commission (1987), this theory emphasises development that "meets the needs of the present without compromising the ability of future generations to meet their own needs." It underscores the integration of economic, social, and environmental objectives, making it directly relevant to balancing growth and climate action in Nigeria.

2.2.3. Energy Transition Theory

Energy transition theory explains structural shifts in energy systems across history from wood to coal, then oil, and now renewables (Smil, 2017). It highlights the role of technology, policy, and societal change in reshaping energy use. For Nigeria, this theory frames the shift from oil dependency toward renewable energy as a multifaceted challenge that involves economic restructuring and social adaptation.

2.3. Empirical Review

Empirical studies have examined the nexus between climate change, energy transition, and economic growth in Nigeria and other developing economies.

Adewuyi and Awodumi (2017) analysed renewable energy consumption and environmental quality in West Africa, finding that the adoption of renewable energy significantly reduces carbon emissions while supporting economic growth. Similarly, Osabuohien et al. (2020) observed that Nigeria's dependence on fossil fuels undermines its climate

commitments and creates vulnerability to oil price shocks, thereby necessitating urgent diversification through renewables.

Oyedepo (2021) highlighted the economic potential of renewable energy in Nigeria, stressing that solar and wind resources could power industrial growth if properly harnessed. However, inadequate infrastructure, policy inconsistency, and limited financing remain major bottlenecks. Akinbami (2020) further noted that, while Nigeria has adopted several climate policies, weak institutional capacity hampers the effective implementation of these policies.

On the economic side, Okonkwo and Eze (2022) argued that a well-managed energy transition could generate green jobs, attract foreign investment, and enhance energy security, thereby fostering sustainable growth. Conversely, studies such as Iwayemi (2019) cautioned that a hasty shift away from fossil fuels without adequate cushioning measures could disrupt government revenues and worsen unemployment in oil-dependent regions.

Globally, empirical evidence suggests that countries that have invested in renewable energy infrastructure-such as South Africa and Morocco-record improved energy access and reduced emissions (IRENA, 2021). These cases offer valuable lessons for Nigeria on the importance of long-term planning, public-private partnerships, and community engagement in the transition process.

3. Methodology

3.1. Research Design

This study employs a qualitative research design, utilising a systematic literature review approach. A literature review is suitable for synthesising existing knowledge, identifying research gaps, and understanding the complex interactions between climate change mitigation, energy transition, and sustainable economic growth (Boell & Cecez-Kecmanovic, 2014). The approach enables a comprehensive analysis of Nigeria-specific studies, policy documents, and international experiences in climate and energy transition management.

3.2. Sources of Data

Data for this study are exclusively secondary and are drawn from:

- Peer-reviewed journal articles (2000–2024) on climate change, energy transition, and sustainable economic growth.
- Government reports and policy documents, including Nigeria's Energy Transition Plan (2022), National Climate Change Policy (2012), and National Renewable Energy and Energy Efficiency Policy (NREEEP, 2015).
- Reports from international organisations, such as the Intergovernmental Panel on Climate Change (IPCC), International Energy Agency (IEA), United Nations Development Programme (UNDP), and the International Renewable Energy Agency (IRENA).
- Conference proceedings, working papers, and credible online sources relevant to the Nigerian context.

3.3. Inclusion and Exclusion Criteria

The review focuses on literature that:

- Addresses the nexus of climate change, energy transition, and sustainable economic growth in Nigeria or comparable developing economies.
- Covers the period 2000–2024 to ensure relevance and currency.
- Articles written in English and is peer-reviewed or published by credible institutions.

Exclusions include:

- Studies unrelated to energy or climate issues.
- Articles with insufficient empirical or policy analysis.
- Duplicated publications or studies focusing solely on non-developing economies without lessons for Nigeria.

3.4. Data Collection Procedure

The literature was collected through structured searches in electronic databases, including Google Scholar, ScienceDirect, JSTOR, SpringerLink, and Wiley Online Library. Keywords used include: "climate change mitigation Nigeria," "energy transition Nigeria," "renewable energy economic growth," "sustainable development Nigeria," and "green economy Nigeria."

After initial retrieval, articles were screened for relevance based on titles and abstracts, followed by full-text review. A total of approximately 120 sources were initially identified, of which 85 were considered most relevant for inclusion in the analysis.

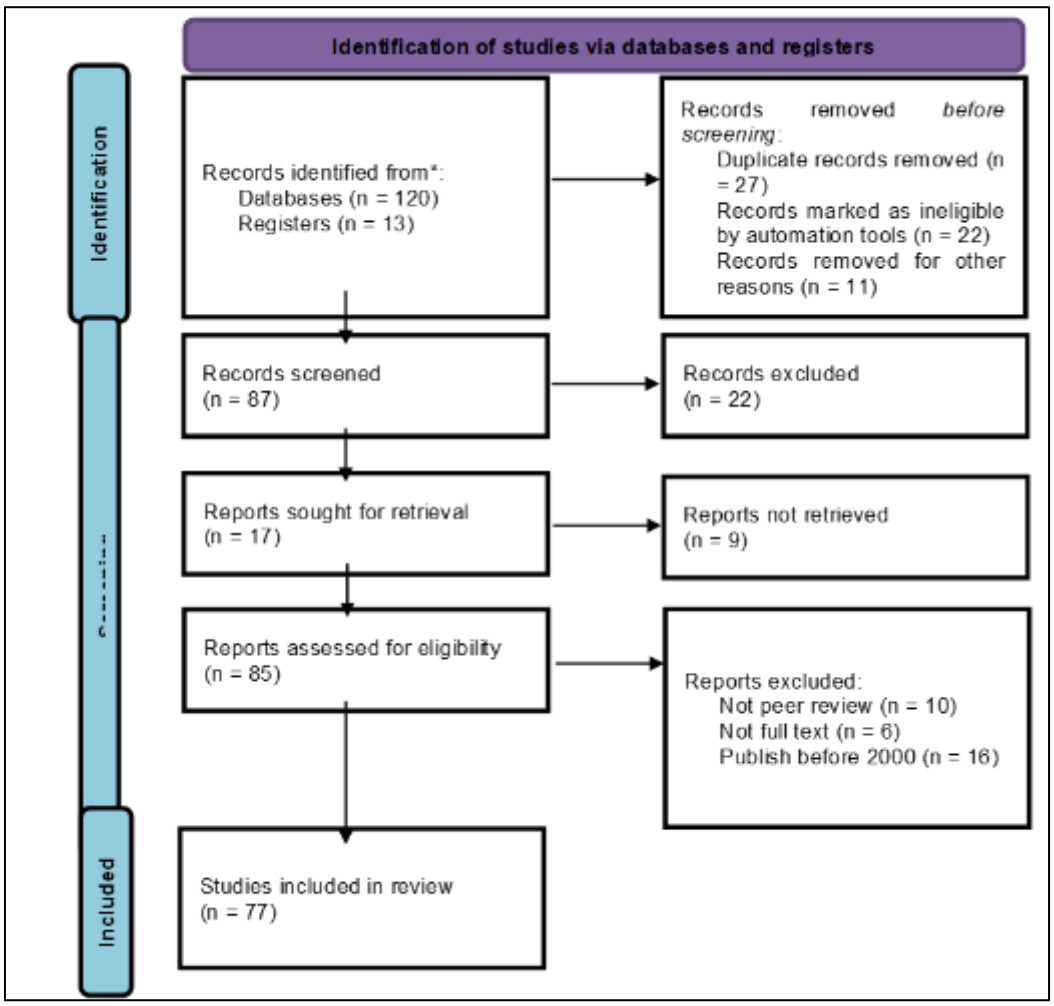

Figure 1 Prisma Flow diagram showing the process of identification, screening, eligibility, and inclusion of studies in the review

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3.5. Data Analysis Technique

Data analysis follows a thematic content analysis approach, which involves identifying recurring themes, patterns, and insights from the literature (Braun & Clarke, 2006). Thematic categories in this study include:

- Climate change impacts on Nigeria's economy.
- The Role and Potential of Renewable Energy in Sustainable Growth.
- Policy Frameworks and Institutional Mechanisms for Energy Transition.
- Challenges and Opportunities in Balancing Mitigation with Economic Growth.

Findings are synthesised in narrative form, supported by tables, charts, and conceptual frameworks where necessary, to highlight key trends, gaps, and implications for policy and practice.

4. Results and Discussion

4.1. Introduction

This chapter presents the findings from the literature review on the interconnections between climate change mitigation, energy transition, and sustainable economic growth in Nigeria. The analysis is structured thematically to highlight significant insights, challenges, and opportunities identified in the reviewed studies.

4.2. Summary of Key Findings

Table 1 Summary of key literature findings on Climate change, Energy Transition, and Economic Growth in Nigeria

S/N	Authors/Year	Country	Methodology	Findings
1	Akinbami (2020)	Nigeria	Review/Secondary data	Climate change negatively impacts agriculture, reducing crop yields and threatening food security.
2	Ojo & Adeoti (2021)	Nigeria	Empirical analysis	Erratic rainfall and flooding disrupt energy production, especially hydropower generation.
3	Adewuyi & Awodumi (2017)	Nigeria	Econometric modeling	Climate change increases health risks, reducing labor productivity and increasing healthcare costs.
4	IPCC (2021)	Global, includes Nigeria	Literature review	Coastal erosion and flooding threaten infrastructure, including roads, ports, and oil facilities.
5	Oyedepo (2021)	Nigeria	Review/Secondary data	Nigeria has abundant renewable energy resources (solar, wind, biomass, hydropower) suitable for mitigation.
6	IEA (2022)	Nigeria	Data analysis	Renewable energy adoption can expand electricity access and support industrial growth.
7	Okonkwo & Eze (2022)	Nigeria	Review and case study	Energy transition can create green jobs in manufacturing, installation, and maintenance sectors.
8	Osabuohien et al. (2020)	Nigeria	Quantitative analysis	Diversifying energy sources reduces vulnerability to oil price fluctuations.
9	IRENA (2021)	Global, lessons for Nigeria	Review	Renewable energy policies can attract foreign investment and climate finance.
10	Akinbami (2020); Osabuohien et al. (2020)	Nigeria	Review/Quantitative analysis	Policy inconsistency reduces investor confidence in renewable energy projects.
11	IEA (2022); Oyedepo (2021)	Nigeria	Secondary data analysis	Limited financing constrains large-scale renewable energy implementation.
12	Okonkwo & Eze (2022)	Nigeria	Review/case study	Technological and human capacity gaps hinder the deployment and maintenance of renewable energy systems.

13	Iwayemi (2019)	Nigeria	Review/Policy analysis	Social resistance arises in communities dependent on fossil fuel-related jobs.
14	Adewuyi & Awodumi (2017)	Nigeria	Econometric modeling	Weak institutional frameworks impede effective climate policy implementation.
15	Adewuyi & Awodumi (2017)	Nigeria	Econometric modeling	Gradual removal of fossil fuel subsidies could encourage energy diversification but may create short-term social costs.
16	IRENA (2021)	Global, lessons for Nigeria	Review	Regional collaboration and knowledge sharing enhance the effectiveness of energy transition strategies.
17	Akinbami (2020); Oyedepo (2021)	Nigeria	Review/Secondary data	Integrated planning across climate, energy, and economic policies is crucial for a balanced and sustainable transition.

4.3. Climate Change Impacts on Nigeria's Economy

The literature indicates that climate change has significant negative impacts on multiple sectors of the Nigerian economy:

- Agriculture: Erratic rainfall, flooding, and desertification reduce crop yields, threatening food security and rural livelihoods (Akinbami, 2020; Ojo & Adeoti, 2021). Agriculture contributes approximately 24% to Nigeria's GDP, making climate impacts a direct threat to the country's economic growth.
- The energy sector is impacted by increased temperatures and variable water flows, which affect hydropower generation. Additionally, oil infrastructure faces risks from rising sea levels and flooding in the Niger Delta (Oyedepo, 2021; Osabuohien et al., 2020).
- Public Health: Climate change exacerbates heat stress, waterborne diseases, and vector-borne diseases, such as malaria, thereby increasing public health expenditures and reducing labour productivity (Adewuyi & Awodumi, 2017).
- Infrastructure: Coastal erosion and flooding pose a significant threat to critical infrastructure, including roads, ports, and oil facilities, resulting in increased repair costs and reduced economic efficiency (IPCC, 2021).

Overall, climate change poses both direct and indirect economic costs, underscoring the need to integrate mitigation measures with sustainable development planning.

4.4. Role of Energy Transition in Mitigating Climate Change and Driving Growth

The literature emphasises that Nigeria’s energy transition can contribute significantly to environmental sustainability and economic development:

- Renewable Energy Potential: Nigeria has substantial solar, wind, biomass, and hydropower resources. Studies suggest that tapping into these resources could increase electricity access, stimulate industrial growth, and reduce carbon emissions (Oyedepo, 2021; IEA, 2022).
- Green Jobs Creation: Transitioning to renewable energy can generate employment opportunities in manufacturing, installation, operation, and maintenance of renewable energy systems (Okonkwo & Eze, 2022).
- Energy Security and Diversification: Reducing dependence on oil decreases vulnerability to global oil price fluctuations and strengthens the resilience of the national economy (Osabuohien et al., 2020).
- Investment Attraction: Policies promoting renewable energy can attract foreign direct investment and international climate finance, supporting economic growth and technology transfer (IRENA, 2021).

4.5. Challenges in Balancing Climate Change Mitigation and Energy Transition

Several obstacles hinder Nigeria's ability to achieve a balanced pathway between mitigation and economic growth:

Table 2 Key challenges hindering Nigeria's balanced approach to climate change mitigation and energy transition

Challenge	Description	Sources
Policy Inconsistency	Frequent changes in energy and climate policies reduce investor confidence	Akinbami, 2020; Osabuohien et al., 2020
Financing Gaps	Limited public and private financing for renewable projects	IEA, 2022; Oyedepo, 2021
Technological Constraints	Insufficient local capacity to produce and maintain renewable energy systems	Okonkwo & Eze, 2022
Social Resistance	Communities dependent on fossil fuel jobs resist transition measures	Iwayemi, 2019
Institutional Weakness	Weak regulatory enforcement and coordination impede implementation	Adewuyi & Awodumi, 2017

These challenges indicate that policy coherence, financial innovation, capacity building, and social inclusion are crucial for a successful energy transition.

4.6. Policy and Institutional Responses

The literature identifies several policy initiatives aimed at balancing climate action with economic growth in Nigeria:

- National Climate Change Policy (2012): Provides a framework for mitigation and adaptation measures across sectors.
- Nigeria Energy Transition Plan (2022): Targets achieving net-zero emissions by 2060 while expanding renewable energy access.
- Renewable Energy and Energy Efficiency Policy (NREEEP, 2015): Focuses on promoting renewable energy technologies and energy efficiency practices.
- Subsidy Reforms: Gradual removal of fossil fuel subsidies to encourage energy diversification, although this has social and political implications (Adewuyi & Awodumi, 2017).

Empirical evidence suggests that successful policy implementation requires institutional coordination, stakeholder engagement, and monitoring mechanisms to ensure that climate and growth objectives are aligned.

5. Discussion

The findings indicate a complex interplay between climate change mitigation, energy transition, and economic growth in Nigeria:

- **Mitigation-Economic Trade-offs:** Efforts to reduce emissions can conflict with short-term economic goals, particularly in oil-dependent regions.
- **Opportunity for Green Growth:** A well-managed transition could create new industries, reduce energy poverty, and improve energy security.
- **Importance of Policy Coherence:** Fragmented and inconsistent policies reduce the effectiveness of mitigation and transition strategies.
- **Social Inclusion:** Engaging communities in transition planning is essential to avoid social resistance and ensure equitable benefits.

In essence, the literature highlights that balancing climate action with sustainable growth requires integrated planning, robust institutions, and targeted investments in renewable energy and human capital.

5.1. Summary of Findings

This study reviewed literature on the interconnections between climate change mitigation, energy transition, and sustainable economic growth in Nigeria. The key findings are summarised as follows:

- Climate Change Impacts: Climate change significantly affects agriculture, energy, public health, and infrastructure in Nigeria, posing direct and indirect costs to economic growth (Akinbami, 2020; Ojo & Adeoti, 2021).
- Energy Transition Potential: Nigeria has abundant renewable energy resources—solar, wind, hydropower, and biomass—that can enhance energy access, stimulate industrial growth, and reduce greenhouse gas emissions (Oyedepo, 2021; IEA, 2022).
- Economic and Social Benefits: Transitioning to renewable energy offers opportunities for green job creation, investment attraction, and energy security, contributing to sustainable economic growth (Okonkwo & Eze, 2022; IRENA, 2021).
- Challenges: Policy inconsistency, financing gaps, technological constraints, institutional weaknesses, and social resistance are significant barriers to balancing climate change mitigation and energy transition (Adewuyi & Awodumi, 2017; Iwayemi, 2019).
- Policy Responses: Nigeria has initiated several policy measures, including the National Climate Change Policy (2012), Energy Transition Plan (2022), and Renewable Energy and Energy Efficiency Policy (2015). However, effective implementation remains limited due to weak institutions and inadequate stakeholder engagement.

6. Conclusion

The literature reviewed demonstrates that balancing climate change mitigation with sustainable economic growth in Nigeria is both necessary and feasible, but requires a multidimensional approach. While mitigation efforts are essential to reduce environmental risks and meet global climate commitments, they must be carefully aligned with economic and social objectives to avoid adverse impacts on livelihoods and government revenues.

A successful energy transition can provide significant economic opportunities, including job creation, technological advancement, and improved energy access. However, achieving this balance demands coherent policies, robust institutional frameworks, financial innovation, and social inclusion to ensure a just transition.

6.1. Recommendations

- Policy Coherence and Implementation: The government should harmonise climate and energy policies, ensuring consistency across ministries and agencies to enhance investor confidence and policy effectiveness.
- Financial Support and Incentives: Expand financing mechanisms, including public-private partnerships, green bonds, and international climate funds, to support renewable energy projects and research.
- Capacity Building and Technology Transfer: Invest in human capital and technological infrastructure to improve local capacity for renewable energy production, maintenance, and innovation.
- Social Inclusion and Just Transition: Engage communities, especially those dependent on fossil fuel activities, in transition planning to ensure equitable distribution of benefits and minimise resistance.
- Monitoring and Evaluation: Establish robust monitoring and evaluation frameworks to track progress on climate mitigation, energy transition, and economic growth objectives, enabling data-driven adjustments.
- Regional Collaboration: Collaborate with other African nations and international organisations to share best practices, access technology, and attract investment in renewable energy.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of Interest to be disclosed.

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