


Perspective

# Credible Pathways to Catching Up with Climate Goals in Nigeria

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**Abstract:** This paper seeks to address Nigeria's challenges in meeting its climate objectives by investigating feasible pathways that can be implemented to accelerate progress and ensure credibility in meeting these targets. By examining the current policies and practices in place as well as successful strategies employed by other countries, this paper aims to provide strategies and policy implications recommendations for Nigeria to enhance its climate action efforts. The potential scenarios developed in this study ranged from increasing renewable energy capacity to implementing stricter regulations and standards for industries to reduce their carbon footprint, promote sustainable production processes, and strengthen climate governance and policy frameworks. The authors further investigated these measures and discovered that implementing stricter regulations and standards for industries would reduce their carbon footprint, promote sustainable production processes, and strengthen climate governance and policy frameworks. As such, Nigeria will be able to meet its climate goals more quickly as a result of the following factors: preventing environmental degradation, funding environmentally friendly infrastructure, and improving public transportation systems that can reduce vehicle-related greenhouse gas emissions. The authors developed policy measures based on the proposed twelve credible pathways to catching up with climate goals in Nigeria, thereby promoting faster progress by the Nigerian government in achieving climate goals. By adopting these measures, Nigeria's progress toward the proposed zero net by 2060 will be significantly accelerated. It will position Nigeria as a continental leader in sustainable development and contribute to the overall global efforts to mitigate climate change. This will not only benefit the environment but also lead to financial development and an improved standard of living for its citizens.



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## 1. Introduction

Nigeria, a developing country, grapples with the task of harmonizing its economic progress and its dedication to addressing climate change. This challenge arises due to Nigeria's heavy reliance on fossil fuels for energy generation [1] and its vulnerability to the impacts of climate change [2], such as extreme weather events [3] and rising sea levels [4]. The country's rapidly growing population further exacerbates the need for sustainable development practices that can provide economic opportunities while minimizing environmental degradation [5]. Nigeria's fossil fuel industry, particularly its oil sector [6], has been a major driver of economic growth and government revenue [7]. This reliance on fossil fuels has contributed significantly to greenhouse gas emissions and environmental degradation [8]. As a result, Nigeria is facing the challenge of transitioning to cleaner [9] and more sustainable sources of energy [10] to mitigate the impacts of climate change [11]. The government has recognized the need for diversification and has started investing in renewable energy projects [12] to reduce its dependence on fossil fuels [13]. These renewable energy projects include the development of solar power plants [14], wind farms, and hydroelectric facilities.

By investing in these alternative energy sources, Nigeria aims to not only reduce its carbon footprint [15] but also create new job opportunities and stimulate economic growth in the renewable energy sector [16]. The government is implementing policies and incentives to encourage private sector involvement in renewable energy investments [17], further accelerating the transition towards a cleaner and more sustainable energy future for Nigeria [18]. The implementation process is still in its early stages [19,20]. Despite these obstacles, the government is committed to overcoming them through partnerships with international organizations and increasing public awareness about the benefits of renewable energy. With continued support and investment, Nigeria has the potential to become a leader in clean energy innovation [21] and contribute significantly to global efforts to combat climate change [20].

In many Asian countries, particularly Pakistan, Sri Lanka, Nepal, and the Maldives, dependency on fossil fuel consumption causes the problem of sustainable energy development [22,23]. Similarly, in Nigeria, the current reliance on fossil fuels and lack of widespread access to electricity in rural areas hinder the country's progress towards a sustainable energy future. Political instability and corruption pose additional barriers to the implementation of renewable energy projects. The transition to renewable energy in Nigeria has been slow. Many communities still rely heavily on fossil fuels for their energy needs, leading to high levels of pollution and environmental degradation [19]. With the right policies and incentives in place, there is hope that Nigeria can accelerate its clean energy transition and reap the economic and environmental benefits that come with it. There are still barriers to the widespread adoption of renewable energy in Nigeria. One major challenge is the high cost of transitioning to clean energy sources, which can be a deterrent for both individuals and businesses [3]. There is a lack of skilled workers and technical expertise in the renewable energy sector, which hinders the implementation and maintenance of renewable energy projects. With targeted training programs and incentives for investment, these barriers can be overcome, paving the way for a sustainable and greener future for Nigeria [20].

The limited infrastructure for renewable energy, such as transmission lines [17] and storage facilities, poses another obstacle to widespread adoption. The intermittent nature of some renewable energy sources, like solar and wind power, requires the development of efficient energy storage solutions to ensure a reliable and consistent supply of clean energy. With strategic investments in infrastructure development and research into advanced storage technologies, these challenges can be addressed, and Nigeria can unlock the full potential of its renewable energy resources. By investing in infrastructure development, such as building more solar and wind farms [15], Nigeria can increase its renewable energy capacity and reduce its reliance on fossil fuels [16]. Conducting research into advanced storage technologies, such as battery storage systems or hydrogen fuel cells, can help overcome the intermittent nature of renewable energy sources and ensure a stable energy supply for the country [20].

Achieving credible pathways that Nigeria can take to catch up with its climate goals requires a multi-faceted approach that addresses various challenges. One of the challenges is the lack of renewable energy capacity in Nigeria, which hinders the country's ability to reduce its reliance on fossil fuels and transition to cleaner sources of energy. This can be attributed to factors such as limited investment in renewable infrastructure, inadequate policies and regulations, and a lack of awareness among the population about the benefits of renewable energy. The lack of enhanced energy efficiency measures and promotion of sustainable practices in industries such as agriculture and transportation in Nigeria also contribute to the country's limited capacity to transition to cleaner sources of energy. Without proper energy efficiency measures, industries consume more energy than necessary, increasing their reliance on fossil fuels.

The lack of waste management systems in Nigeria, the improper application of the principles of the circular economy, the lack of funding for clean energy research and development; the lack of implementation of stricter regulations and standards for industries in

Nigeria to reduce their carbon footprint and advance sustainable production are additional challenges. These challenges contribute to the high levels of pollution and environmental degradation in the country. They also hinder Nigeria's ability to transition towards a more sustainable and environmentally friendly economy. Addressing these challenges requires a comprehensive approach that involves investment in waste management infrastructure, promoting renewable energy sources, and enforcing stricter environmental regulations.

In this perspective paper, we explore the various credible pathways that Nigeria can take to catch up with its climate goals. Nigeria, as one of the largest emitters of greenhouse gases in Africa, faces significant challenges in meeting its climate targets. However, with careful planning and implementation of sustainable strategies, there are viable options for Nigeria to bridge the gap and make substantial progress towards achieving its climate goals. These options include increasing renewable energy capacity, improving energy efficiency, promoting sustainable agriculture practices, enhancing waste management systems, implementing green transportation solutions, adopting circular economy principles, investing in green infrastructure projects, supporting research and development of clean energy technologies, collaborating with other countries to establish international agreements and targets for reducing greenhouse gas emissions on a global scale, educating the public about the importance of sustainable practices and encouraging them to adopt environmentally friendly behaviors in their daily lives, implementing stricter regulations and standards for industries to reduce their carbon footprint and promote sustainable production processes, and strengthening climate governance and policy frameworks. These scenarios aim to create a unified Nigerian response to climate change and ensure that the country is on track to meet its commitments under international climate agreements.

It is crucial to concentrate on a few key scenarios that can result in significant progress in order to make sure that Nigerians can fully benefit from credible pathways that Nigeria can take to catch up with its climate goals. By focusing on these key scenarios, policymakers and stakeholders can prioritize initiatives such as transitioning to renewable energy sources, implementing sustainable agricultural practices, and improving waste management systems. These targeted efforts will not only contribute to Nigeria's climate goals but also enhance the country's overall sustainability and resilience, ensuring a brighter future for all Nigerians.

Therefore, the problem statement of the paper was to identify and analyze effective strategies and measures that can enable Nigeria to bridge the gap between its current climate targets and the desired goals. This study aims to address the challenges faced by Nigeria in achieving its climate objectives, exploring feasible pathways that can be implemented to accelerate progress and ensure credibility in meeting these goals. The research question for the paper was, What are the key challenges and opportunities for Nigeria in achieving its climate goals, and what are the most effective strategies and policy measures that can enable Nigeria to catch up with its climate targets? Nigeria can make significant strides toward meeting its climate goals and contributing to global efforts to combat climate change with strategies that include proposed twelve credible pathways and policy measures. These pathways and policy measures encompass various sectors such as energy, agriculture, transportation, and waste management. By putting these strategies into practice, Nigeria can promote and achieve sustainable development goals, which will open up new economic opportunities while also lowering its greenhouse gas emissions.

The paper's structure is organized as follows: The introduction to the paper is the main topic of this part. The second section discusses potential scenarios for Nigeria's approaches to catching up with climate targets. A potential scenario for Nigeria's approach to meeting its climate targets more rapidly is discussed in section three. The fourth part discusses possibilities that could prevent Nigeria from achieving its climate targets. The scenario that would most likely hasten Nigeria's progress toward the desired zero net by 2060 is discussed in the fifth section. The last part covers the goals, procedures, findings, summary of the findings, policy implications, limitations, and suggestions for further research, as outlined in section six. This comprehensive analysis provides a holistic view of Nigeria's

climate targets and the various factors that could impact its ability to achieve them. By considering both potential accelerators and obstacles, policymakers can make informed decisions to ensure Nigeria’s successful transition towards a sustainable future. The focal point of the conceptual/theoretical framework is depicted in Figure 1.

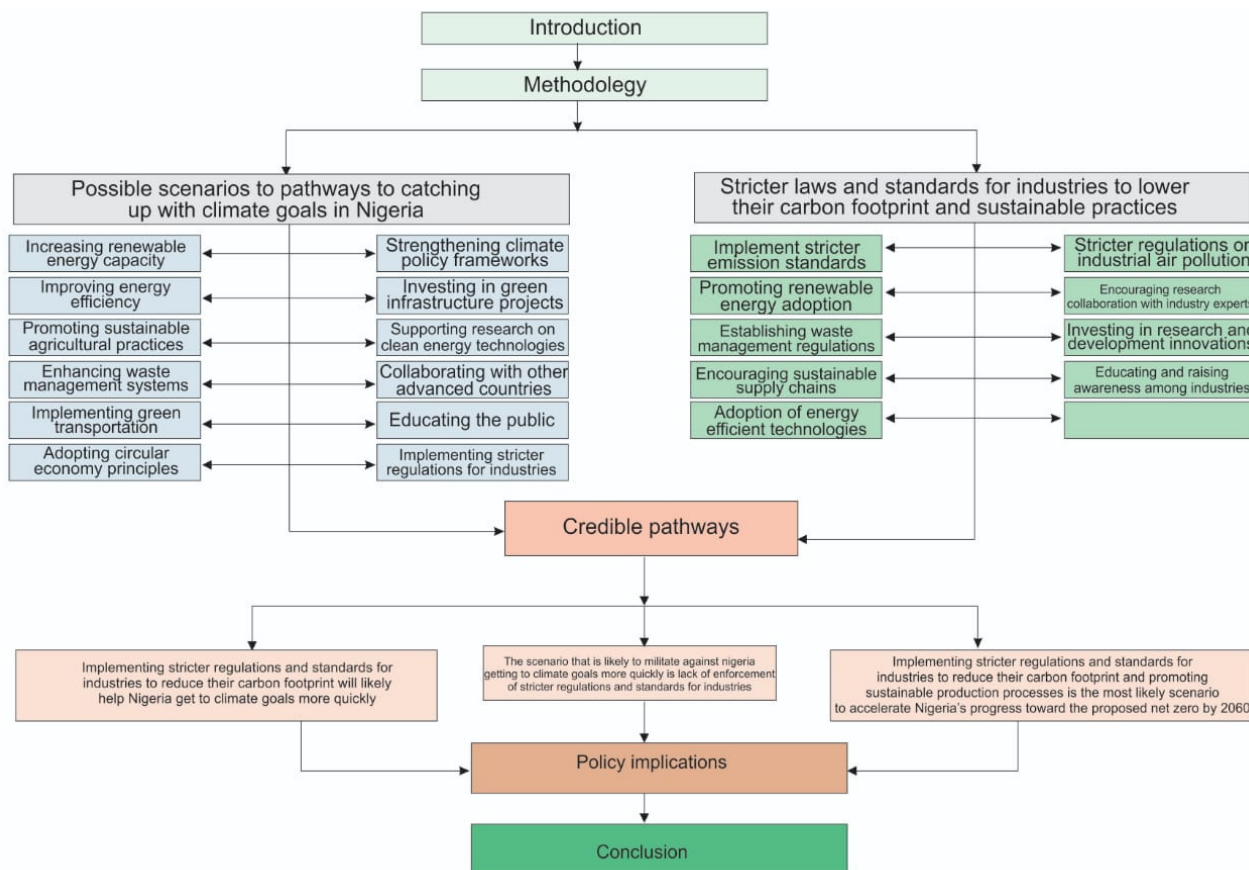
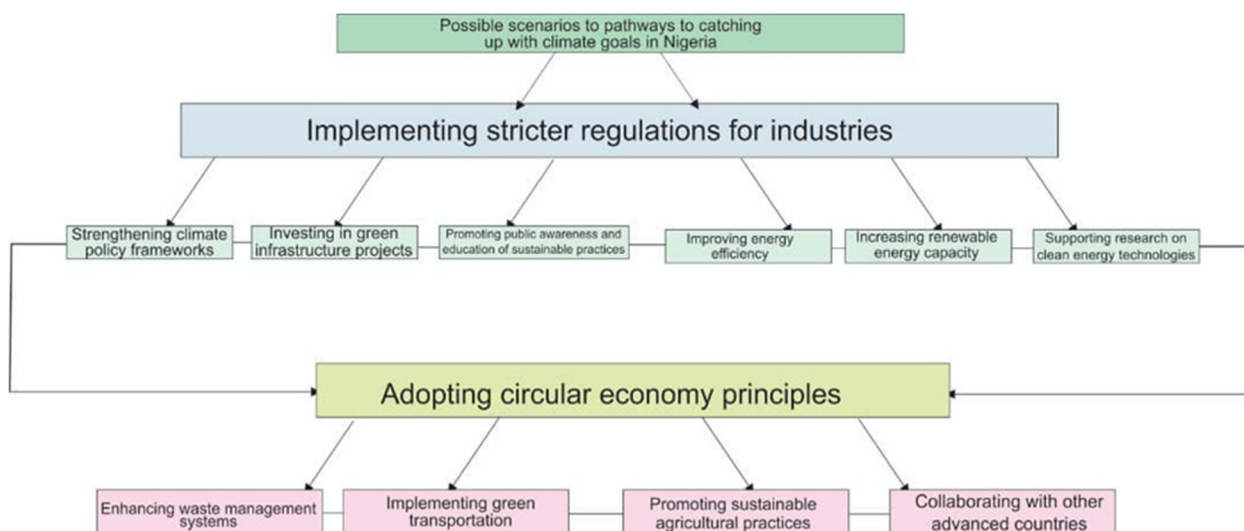


Figure 1. A flowchart or theoretical framework for the study.

## 2. Possible Scenarios for Pathways to Catching Up with Climate Goals in Nigeria

The theoretical underpinnings of credible pathways to catching up with climate goals in Nigeria are as follows: (1) increasing renewable energy capacity, (2) improving energy efficiency, (3) promoting sustainable agriculture practices, (4) enhancing waste management systems, (5) implementing green transportation solutions, (6) adopting circular economy principles, (7) strengthening climate governance and policy frameworks; (8) investing in green infrastructure projects, such as green buildings and renewable energy installations, to create jobs and stimulate economic growth; (9) supporting research and development of clean energy technologies to further advance the transition to a low-carbon economy; (10) collaborating with other countries to establish international agreements and targets for reducing greenhouse gas emissions on a global scale; (11) educating the public about the importance of sustainable practices and encouraging them to adopt environmentally friendly behaviors in their daily lives; (12) implementing stricter regulations and standards for industries to reduce their carbon footprint and promote sustainable production processes. Figure 2 shows the various suggested options for achieving sustainable development in Nigeria in a hierarchical order. For Nigeria to catch up with climate goals, the scenarios listed above must be implemented in a timely and effective manner. These scenarios account for the key strategies needed to reduce greenhouse gas emissions and promote sustainable development. By adopting these measures, Nigeria can make significant progress toward achieving its climate goals and contribute to global efforts to mitigate climate change.



**Figure 2.** Shows the various suggested options for achieving sustainable development in Nigeria in a hierarchical order.

### 2.1. Increasing Renewable Energy Capacity Scenario

Increasing renewable energy capacity is a crucial aspect of Nigeria's efforts to catch up with its climate goals. As of 2021, Nigeria's renewable energy sources contribute to approximately 13% of the country's total energy consumption [24]. This figure highlights the progress made in transitioning towards cleaner energy sources. However, it is important to note that there is still significant room for improvement, as the Nigerian government aims to increase the share of renewable energy to 30% by 2030 [25]. This commitment reflects Nigeria's recognition of the importance of transitioning towards sustainable energy systems to mitigate climate change and enhance energy security.

By investing in and expanding the use of renewable energy sources such as solar, wind, and hydropower, Nigeria can significantly reduce its reliance on fossil fuels and decrease greenhouse gas emissions. This transition to clean energy not only helps combat climate change but also promotes sustainable economic growth and job creation in the country. By diversifying its energy sources, Nigeria can enhance its energy security and reduce its vulnerability to fluctuations in global oil prices. The development of renewable energy infrastructure can also improve access to electricity in rural areas, thereby contributing to poverty alleviation and improving the quality of life for millions of Nigerians. Investing in renewable energy can reduce Nigeria's reliance on fossil fuels, mitigating the environmental impact of extraction and combustion. This transition towards cleaner energy sources aligns with international commitments.

Investing in renewable energy can create new job opportunities and stimulate economic growth in Nigeria. By harnessing the country's abundant renewable resources, such as solar and wind power, Nigeria can establish a sustainable and resilient energy sector that benefits both its people and the environment. Transitioning towards cleaner energy sources is crucial for reducing greenhouse gas emissions. By reducing reliance on fossil fuels, Nigeria can mitigate the negative impacts of pollution and create a healthier living environment for its citizens. Investing in renewable energy can also enhance energy security by diversifying the country's energy mix and reducing dependence on imported fossil fuels. Embracing renewable energy can stimulate economic growth and create job opportunities in Nigeria. The development and maintenance of renewable energy infrastructure can generate employment in sectors such as manufacturing, construction, and research. This can contribute to the overall well-being of the country's economy and provide a sustainable future for its citizens. Investing in renewable energy can also help Nigeria mitigate the environmental impacts of traditional fossil fuel consumption. By reducing greenhouse gas emissions and promoting cleaner energy sources, the country can contribute to global

efforts to combat climate change. In Nigeria, there are several programs available to increase the percentage of renewable energy usage. One such program is the Renewable Energy Master Plan (REMP), which aims to achieve a 30% renewable energy contribution to the country's total energy mix by 2030 [21]. This program focuses on promoting the development of solar, wind, hydro, and biomass energy sources. Additionally, the Nigerian government has implemented guidelines and targets to support the adoption of renewable energy. For instance, the National Renewable Energy and Energy Efficiency Policy (NREEEP) set a target of 10% renewable energy contribution by 2025 [21]. This policy provides incentives and regulatory frameworks to attract investment in renewable energy projects and encourages the use of clean technologies across various sectors. Furthermore, the government has established the Rural Electrification Agency (REA) to facilitate the deployment of renewable energy solutions in rural areas, ensuring access to clean and sustainable power for all Nigerians [21].

Several countries have expressed their willingness to cooperate with Nigeria in increasing the percentage of renewable energy used. For instance, Germany has shown interest in collaborating with Nigeria through its bilateral cooperation programs, aiming to support the development of renewable energy projects. Additionally, China has also expressed its readiness to work with Nigeria to promote renewable energy utilization as part of their broader partnership on sustainable development initiatives. These partnerships highlight the global recognition of Nigeria's potential in renewable energy and the importance of transitioning to cleaner sources. The collaborations with Germany and China can pave the way for knowledge exchange, technology transfer, and financial support to accelerate Nigeria's renewable energy sector.

## 2.2. Improving Energy Efficiency

Improving energy efficiency is a crucial theoretical underpinning for Nigeria to achieve its climate goals. According to a report by the International Energy Agency (IEA) [24], Nigeria has made significant progress in improving energy efficiency in recent years. The country has implemented various measures, such as promoting the use of energy-efficient appliances, adopting energy management systems, and investing in renewable energy sources like solar power. For instance, the Nigerian Energy Support Programme (NESP) has successfully facilitated the deployment of over 100,000 solar home systems across rural communities, reducing their reliance on fossil fuels and increasing energy efficiency [21]. Additionally, the government has also introduced policies and incentives to encourage energy conservation and the adoption of green technologies. These include tax breaks for businesses that invest in energy-efficient equipment and grants for homeowners who install solar panels or upgrade their insulation. These initiatives have not only helped reduce energy consumption but have also created new job opportunities in the renewable energy sector, contributing to the country's overall economic growth.

By implementing energy-efficient technologies and practices, such as upgrading infrastructure and promoting the use of renewable energy sources, Nigeria can reduce its greenhouse gas emissions while still meeting its growing energy demands. This approach not only helps mitigate climate change but also brings economic benefits by reducing energy costs and enhancing energy security in the long run. Investing in energy efficiency can create job opportunities and stimulate economic growth. By supporting the development of a green economy, Nigeria can attract investments and improve its competitiveness in the global market. Energy-efficient practices can also improve the quality of life for Nigerian citizens by reducing air pollution and improving access to reliable and affordable energy services. Energy-efficient practices can also lead to a reduction in greenhouse gas emissions, contributing to Nigeria's efforts to combat climate change. By promoting energy efficiency, Nigeria can reduce its dependence on fossil fuels and diversify its energy sources, making it more resilient to fluctuations in global oil prices.

According to a report by the International Energy Agency (IEA), Nigeria's energy imports have significantly decreased over the past decade. In 2010, Nigeria imported ap-

proximately 80% of its energy needs, whereas by 2020, this number had dropped to around 40% [24]. This reduction in energy imports has made Nigeria more resilient to fluctuations in global oil prices. Furthermore, the diversification of Nigeria's energy sources has played a crucial role in enhancing its resilience. The country has been actively investing in renewable energy projects, such as solar and wind power, as well as exploring its vast natural gas reserves. These efforts have not only helped to decrease Nigeria's reliance on imported energy but have also contributed to a more sustainable and environmentally friendly energy sector. Additionally, the government has implemented policies to promote domestic production and consumption of renewable energy, further supporting the country's energy independence and reducing its vulnerability to external factors. Energy-efficient practices can stimulate economic growth and create job opportunities in the renewable energy sector. This can help boost Nigeria's economy and provide sustainable livelihoods for its citizens. By embracing energy efficiency, Nigeria can set an example for other countries in the region and inspire them to adopt similar measures, fostering regional cooperation and collaboration towards a greener future.

### *2.3. Promoting Sustainable Agriculture Practices*

Promoting sustainable agriculture practices in Nigeria can play a crucial role in achieving the country's climate goals. According to a report by the Food and Agriculture Organization (FAO), Nigeria has made significant progress in promoting sustainable agriculture practices. The report states that approximately 35% of farmers in Nigeria have adopted sustainable agricultural techniques, such as organic farming, agroforestry, and integrated pest management [26]. These practices aim to minimize environmental impact, conserve natural resources, and ensure long-term food security.

By implementing sustainable farming techniques such as agroforestry, organic farming, and efficient irrigation systems, Nigeria can reduce greenhouse gas emissions from the agricultural sector while ensuring food security and economic growth. Sustainable agriculture practices can help build resilience to climate change impacts, such as droughts and floods, by conserving soil health, preserving water resources, and promoting biodiversity. These practices can also contribute to the reduction of deforestation and land degradation, as sustainable farming techniques prioritize the conservation of natural resources. Adopting sustainable agriculture practices can create new employment opportunities and improve the livelihoods of farmers, contributing to overall rural development in Nigeria. In addition, sustainable agriculture practices can also help mitigate climate change by reducing greenhouse gas emissions through the use of organic fertilizers and crop rotation techniques. By promoting agroforestry and integrating trees into farming systems, sustainable agriculture can enhance carbon sequestration and contribute to the restoration of degraded lands. These practices not only benefit the environment but also have economic advantages. Sustainable agriculture can create new job opportunities in rural areas, boost local economies, and reduce poverty.

According to a report by the Food and Agriculture Organization (FAO), sustainable agriculture has the potential to significantly contribute to local economies and poverty reduction in Nigeria [26]. The report highlights that sustainable agricultural practices can increase productivity, improve food security, and generate employment opportunities, thus stimulating economic growth in rural areas [26]. Additionally, a study conducted by Ojo et al. [27] found that adopting sustainable agricultural practices resulted in higher incomes for small-scale farmers in Nigeria, leading to improved living standards and reduced dependency on external aid. This indicates that promoting sustainable agriculture not only benefits the local economy but also empowers farmers to become self-sufficient and resilient in the face of economic challenges.

By promoting biodiversity and natural resource conservation, sustainable agriculture ensures the long-term viability of farming communities and preserves ecosystems for future generations. Sustainable agriculture practices can also improve soil health and fertility, leading to higher crop yields and increased food security. By using organic fertilizers

and implementing crop rotation techniques, farmers can minimize the use of synthetic chemicals and reduce the risk of soil degradation. This not only benefits the farmers themselves but also helps to safeguard the availability of nutritious food for a growing global population. Sustainable agriculture practices promote biodiversity by preserving natural habitats and reducing the reliance on monoculture farming. This diversification of crops and ecosystems helps to create a more resilient agricultural system that is better equipped to withstand pests, diseases, and climate change impacts.

One policy that supports crop diversification and biodiversity in Nigeria is the National Agricultural Research Policy. This policy emphasizes the need for research and development in agriculture, including the promotion of diverse crops and the conservation of biodiversity. According to a study by Baiyegunhi et al. [28], this policy has led to the introduction of new crop varieties and improved farming practices, contributing to increased crop diversification and the preservation of genetic resources in Nigeria. Additionally, the Nigerian Agricultural Transformation Agenda (ATA) also promotes crop diversification through the provision of financial incentives and technical support to farmers [21]. This approach aims to reduce the country's reliance on a few staple crops and enhance food security by encouraging the cultivation of a wider range of crops with different nutritional values and market potentials.

Ultimately, investing in sustainable agriculture is crucial for ensuring long-term food security and protecting Nigeria's natural resources. One actionable step that policymakers or local communities can take to invest in sustainable agriculture in Nigeria is to prioritize the development and implementation of agricultural extension services. These services can provide farmers with the necessary knowledge, skills, and resources to adopt sustainable farming practices. For example, training programs on organic farming techniques, water conservation methods, and integrated pest management can be organized to promote sustainable agriculture. Policymakers and local communities can encourage the establishment of farmer cooperatives and support networks. These platforms can facilitate knowledge sharing, collaboration, and collective decision-making among farmers. By sharing experiences and best practices, farmers can learn from each other and find innovative solutions to common challenges. Moreover, these networks can also provide access to resources such as equipment, seeds, and financing options, further enabling farmers to adopt sustainable farming practices.

#### *2.4. Enhancing Waste Management Systems*

Enhancing waste management systems in Nigeria is crucial for achieving the country's climate goals. According to a report by the World Bank in 2018, Nigeria has made significant progress in enhancing waste management systems [29]. The report indicated that approximately 26% of the waste generated in Nigeria was being properly managed at that time. According to a report by the World Bank, Nigeria faces significant challenges in waste management, with only about 40% of generated waste being collected and disposed of properly [29]. To address this issue, the Nigerian government has been implementing various strategies to enhance waste management systems. One such initiative is the establishment of waste-to-energy plants, which convert organic waste into electricity or fuel. For instance, the Odogbolu Integrated Waste Management Facility in Ogun State utilizes anaerobic digestion technology to generate biogas, which is then used to produce electricity [27]. This not only helps reduce the amount of waste that ends up in landfills but also provides a sustainable source of energy. Additionally, the government has also been promoting recycling and waste segregation programs to encourage citizens to properly manage their waste and reduce the overall volume of waste generated.

Proper waste management can significantly reduce greenhouse gas emissions by minimizing the release of methane from landfills and promoting recycling and composting. It can create opportunities for job creation and economic growth through the development of a circular economy that focuses on reducing, reusing, and recycling waste materials. A circular economy is a groundbreaking approach to waste management in Nigeria that aims



to transform the traditional linear model of “take-make-dispose” into a more sustainable and resource-efficient system. In this context, waste is no longer seen as a burden but rather as a valuable resource that can be recycled, reused, or repurposed within the economy. By implementing circular economy principles, Nigeria can minimize waste generation, reduce environmental pollution, and create new economic opportunities through the development of recycling industries and the promotion of eco-friendly practices. This shift towards a circular economy can also contribute to the conservation of natural resources and the mitigation of climate change impacts. It can foster innovation and collaboration among different sectors, leading to a more resilient and inclusive economy for Nigeria.

Improving waste management practices can also help mitigate the negative impacts of climate change on public health. Inadequate waste disposal methods can lead to the spread of diseases and contamination of water sources, exacerbating health issues in communities. Water contamination and the subsequent spread of diseases in Nigeria have been significant concerns, with numerous examples and case studies illustrating the severity of the issue. For instance, a study conducted by Umegbolu and Offor [30] found that in rural communities in Nigeria, water sources such as wells and boreholes were contaminated with fecal coliforms, leading to outbreaks of waterborne diseases like cholera and typhoid fever. Additionally, a report by Raimi [31] highlighted the alarming fact that only 19% of the rural population in Nigeria has access to basic sanitation facilities, further exacerbating the problem of water contamination in 2019. This lack of proper sanitation infrastructure not only increases the risk of waterborne diseases but also hampers efforts to effectively address and mitigate the issue. By implementing effective waste management systems, Nigeria can safeguard the well-being of its citizens and contribute to a healthier and more sustainable future.

Proper waste management can also contribute to the conservation of natural resources and reduce the need for raw material extraction. This can help protect ecosystems and preserve biodiversity, ensuring a more balanced and resilient environment for future generations. One specific challenge to the conservation of natural resources and biodiversity in Nigeria is the rapid population growth. With a population of over 200 million people, the demand for resources such as land, water, and energy is increasing at an alarming rate [29]. This puts immense pressure on ecosystems and wildlife habitats, leading to habitat destruction and the loss of biodiversity. Another significant challenge is the illegal wildlife trade. Nigeria serves as a major transit point for the trafficking of endangered species, including elephants, pangolins, and rhinos. This illegal trade not only threatens the survival of these species but also contributes to organized crime and undermines conservation efforts. Additionally, the rapid urbanization and industrialization in Nigeria have led to increased pollution levels, further degrading the environment and impacting the health of both humans and wildlife.

By promoting a circular economy and embracing sustainable waste management practices, Nigeria can not only address immediate health concerns but also work towards long-term environmental sustainability. Implementing sustainable waste management practices in Nigeria can have numerous benefits for the environment and future generations. Proper waste management can help reduce pollution and greenhouse gas emissions, which are major contributors to climate change. Recycling and reusing materials can conserve energy and reduce the demand for new resources, leading to a more sustainable use of natural resources. Implementing sustainable waste management practices in Nigeria can also help the country meet its international commitments to reduce carbon emissions and combat climate change.

### *2.5. Implementing Green Transportation Solutions*

Green transportation solutions are essential for Nigeria to achieve its climate goals. This includes promoting the use of electric vehicles, improving public transportation systems, and investing in infrastructure for cycling and walking. According to a study conducted by the Nigerian Institute of Transport Technology, green transportation solutions have been implemented in Nigeria to address the growing environmental concerns. One

notable initiative is the introduction of electric buses in major cities like Lagos and Abuja. These buses are powered by electricity, reducing carbon emissions and improving air quality. Additionally, the government has also invested in the construction of bicycle lanes and pedestrian-friendly infrastructure to encourage non-motorized modes of transport.

By implementing these measures, Nigeria can reduce greenhouse gas emissions from the transportation sector and improve air quality in cities. This can lead to job creation and economic growth through the development of a green transportation industry. Transitioning to sustainable transportation solutions is crucial for Nigeria to align with its climate goals. According to a study conducted by the International Energy Agency (IEA), hydrogen-powered vehicles have the potential to play a significant role in reducing greenhouse gas emissions and achieving sustainable transportation. The IEA estimates that by 2050, hydrogen could power around 400 million cars globally, representing about 20% of the total vehicle fleet. Furthermore, major automakers such as Toyota, Hyundai, and Honda have already introduced hydrogen fuel cell vehicles (FCVs) to the market. For instance, Toyota's Mirai and Hyundai's Nexo have gained popularity due to their long driving range and quick refueling times [29]. The development of hydrogen infrastructure, such as refueling stations, is also gaining momentum to support the widespread adoption of hydrogen-powered vehicles. In Nigeria, for example, this technology can help address the country's dependence on fossil fuels and reduce its carbon emissions. Moreover, the use of hydrogen fuel cells in Nigeria can also contribute to energy diversification and promote sustainable development in the transportation sector. In addition to promoting electric vehicles, enhancing public transportation systems, and investing in cycling and walking infrastructure, the country should also prioritize the adoption of renewable energy sources to power these modes of transportation. This suggests that in order to support and facilitate the use of electric vehicles, public transportation systems, cycling, and walking infrastructure in Nigeria, it is crucial for the country to prioritize the adoption of renewable energy sources. By doing so, Nigeria can ensure that these modes of transportation are powered by clean and sustainable energy, reducing carbon emissions and environmental impacts. This approach aligns with global efforts to combat climate change and promote a greener future for transportation. By harnessing clean energy, Nigeria can further mitigate its carbon footprint and contribute to a greener and healthier environment for its citizens.

Furthermore, this shift towards sustainable transportation can attract foreign investments and foster innovation, propelling the country towards economic growth and development. The implementation of renewable energy sources in transportation can also reduce the country's dependence on fossil fuels, thereby increasing energy security and reducing vulnerability to fluctuations in oil prices. According to the International Energy Agency (IEA), in 2019, Nigeria was the largest oil producer in Africa, accounting for about 2.2 million barrels per day [29]. However, this heavy dependence on fossil fuels makes Nigeria vulnerable to fluctuations in global oil prices and market uncertainties. To address this issue, Nigeria has been making efforts to diversify its energy mix and reduce its reliance on fossil fuels. One of the key strategies is to increase investment in renewable energy sources such as solar, wind, and hydroelectric power. The government has implemented policies and incentives to attract private sector investments in these sectors, aiming to increase the share of renewable energy in the country's total energy consumption. Additionally, Nigeria has been exploring opportunities for natural gas utilization as a cleaner alternative to oil, promoting the development of gas infrastructure and encouraging the use of compressed natural gas (CNG) as a transportation fuel.

By embracing sustainable transportation, Nigeria can position itself as a leader in environmental stewardship and inspire other nations to follow suit in transitioning towards a low-carbon future. Investing in sustainable transportation can also have positive health impacts on the Nigerian population. By reducing air pollution from vehicle emissions, the country can improve air quality and decrease the prevalence of respiratory diseases among its citizens. This, in turn, can lead to a healthier and more productive workforce, contributing to overall societal well-being and economic prosperity. According to a study

conducted by the World Health Organization (WHO), Nigeria experiences high levels of air pollution, particularly in urban areas, which significantly impacts public health. The study estimated that approximately 150,000 premature deaths occur annually in Nigeria due to air pollution-related illnesses such as respiratory diseases and cardiovascular problems [29]. Moreover, the economic burden of these health issues is substantial, with healthcare costs and productivity losses amounting to billions of dollars each year [29]. In addition to the health impacts, air pollution also affects the environment and contributes to climate change. The release of pollutants such as carbon dioxide and methane from industries and vehicles worsens the greenhouse effect, leading to global warming and unpredictable weather patterns. Addressing air pollution in Nigeria is crucial not only for public health but also for the sustainability of the country's ecosystems and future generations.

Embracing sustainable transportation can also enhance Nigeria's energy security. By reducing dependence on fossil fuels and diversifying the energy mix with renewable sources, the country can mitigate the risks associated with volatile oil prices and geopolitical tensions. This will not only provide a more stable and reliable energy supply but also create opportunities for local job creation and technological advancements in the renewable energy sector.

Transitioning towards a low-carbon future through sustainable transportation will not only benefit the environment and public health but also strengthen Nigeria's economy and reduce its dependence on fossil fuels. By investing in renewable energy infrastructure and promoting the use of electric vehicles, Nigeria can attract foreign investment and diversify its economy. The transition to sustainable transportation will help Nigeria meet its international climate commitments and position itself as a leader in the global fight against climate change and reduce its dependence on fossil fuels. Nigeria has made significant progress in attracting foreign investment, diversifying its economy, and meeting international commitments. According to the World Bank, foreign direct investment (FDI) inflows to Nigeria increased by 36% in 2019, reaching USD 3.3 billion. This demonstrates the growing confidence of international investors in Nigeria's business environment [29]. In terms of diversifying the economy, Nigeria has been focusing on sectors beyond oil and gas. For instance, the agricultural sector has seen remarkable growth with increased investment and government support. This has led to improved productivity, job creation, and increased exports of agricultural products. Additionally, Nigeria has been actively promoting sectors such as manufacturing, technology, and renewable energy to attract more foreign investment and reduce its reliance on oil revenue. These efforts have not only helped in diversifying the economy but also in creating a more sustainable and resilient business environment for both domestic and international investors.

#### *2.6. Adopting Circular Economy Principles*

Circular economy principles focus on minimizing waste and maximizing resource efficiency by promoting the reuse, recycling, and regeneration of materials. The adoption of circular economy principles in Nigeria is gaining momentum as the country recognizes the need for sustainable development. According to a report by the World Bank, Nigeria generates over 32 million tons of solid waste annually, highlighting the urgency of transitioning towards a circular economy model [29]. To address this challenge, the Nigerian government has implemented various initiatives, such as the National Policy on Solid Waste Management and the Extended Producer Responsibility (EPR) program, which encourage waste reduction, recycling, and proper disposal practices. These initiatives aim to promote a shift in mindset and behavior towards a more sustainable approach to waste management. Additionally, the government is also working towards creating awareness among citizens about the importance of waste segregation and the benefits of recycling in order to foster a culture of responsible waste management throughout the country.

By adopting these principles, Nigeria can reduce its carbon footprint and mitigate the negative impacts of climate change. This approach would not only help in achieving climate goals but also create new economic opportunities and improve the overall well-

being of its citizens. Circular economy principles offer a sustainable solution for Nigeria to transition to a low-carbon economy. By implementing policies that encourage the design of products with longer lifespans and promote the sharing economy, Nigeria can reduce its reliance on resource-intensive industries and decrease greenhouse gas emissions.

Embracing principles of the circular economy can also foster innovation and stimulate job creation in sectors such as recycling, renewable energy, and sustainable agriculture. By shifting towards a more circular economy, Nigeria can position itself as a leader in sustainable development and attract investments from both domestic and international sources. According to a recent report by the World Bank, Nigeria has the potential to generate over USD 624 billion in economic value by 2030 through the adoption of circular economy principles [29]. This is further supported by a study conducted by the Ellen MacArthur Foundation, which estimates that transitioning to a circular economy could create up to 170,000 new jobs in Nigeria [32]. These figures highlight Nigeria's potential to become a frontrunner in sustainable economic development within the African continent. With its vast resources and population, Nigeria has the opportunity to lead the way in implementing circular economy practices that not only drive economic growth but also address pressing environmental challenges such as waste management and resource depletion. This transition would not only contribute to mitigating climate change but also enhance the country's resilience to future environmental challenges. Adopting the principles of the circular economy can help Nigeria reduce its dependence on finite resources and minimize waste generation. This would not only lead to cost savings for businesses but also promote the development of new technologies and business models that prioritize sustainability.

Embracing circular economy principles can create new job opportunities and stimulate economic growth in Nigeria. By transitioning to a more sustainable and resource-efficient economy, the country can attract investments and foster innovation in sectors such as renewable energy, waste management, and green technology. Moreover, implementing circular economy principles can help Nigeria reduce its reliance on imported resources and strengthen its domestic supply chains. According to a study by the World Economic Forum, Nigeria currently imports approximately 70% of its raw materials and resources, indicating a heavy reliance on foreign sources [29]. This heavy dependence on imports not only poses economic risks but also leaves the country vulnerable to supply chain disruptions. By implementing principles of the circular economy, such as recycling and reusing materials, Nigeria can reduce its reliance on imported resources and strengthen its domestic supply chains. For instance, a report by the Ellen MacArthur Foundation highlights that transitioning to a circular economy in Nigeria could lead to a significant reduction in the country's import bills and create new opportunities for local businesses [33]. Additionally, adopting circular economy practices can also help Nigeria mitigate environmental degradation caused by the extraction and production of raw materials, leading to a more sustainable and resilient economy. Ultimately, embracing circular economy principles can contribute to a more sustainable and resilient future for Nigeria.

### *2.7. Strengthening Climate Governance and Policy Frameworks*

Strengthening climate governance and policy frameworks is crucial for Nigeria to effectively address climate change and achieve its climate goals. Nigeria has taken significant steps to strengthen climate governance and policy frameworks in recent years. One key initiative is the establishment of the National Climate Change Policy and Response Strategy in 2012, which provides a comprehensive framework for addressing climate change challenges. This policy is supported by the Climate Change Department within the Federal Ministry of Environment, which is responsible for coordinating climate-related activities across various sectors. Additionally, Nigeria has made progress in aligning its national development plans with climate objectives. The country's Economic Recovery and Growth Plan (ERGP) includes specific targets and strategies for addressing climate change and promoting sustainable development. Nigeria has also established the Green Climate Fund (GCF) to mobilize financial resources for climate action projects and initiatives. Further-

more, the country has been actively participating in international climate negotiations and has ratified the Paris Agreement, demonstrating its commitment to global efforts to combat climate change.

By enhancing governance structures, such as establishing clear roles and responsibilities among relevant stakeholders, Nigeria can ensure effective coordination and implementation of climate policies. Robust policy frameworks are needed to provide a solid foundation for the development and implementation of climate action, including mitigation strategies, adaptation measures, and sustainable development plans. These frameworks should incorporate mechanisms for monitoring, reporting, and verifying progress toward climate goals, as well as mechanisms for addressing any potential challenges or barriers that may arise.

It is crucial for Nigeria to actively engage with international partners and participate in global climate initiatives to leverage resources, knowledge, and expertise in tackling climate change effectively. By doing so, Nigeria can enhance its capacity to address climate issues comprehensively and achieve its climate goals in a timely manner. This can be achieved through collaboration with other countries and organizations, sharing best practices, and accessing financial support for implementing climate mitigation and adaptation measures. Nigeria should prioritize the development and implementation of policies and strategies that promote renewable energy sources, sustainable agriculture practices, and efficient waste management systems to reduce greenhouse gas emissions and enhance resilience to climate change impacts.

According to a study conducted by the Nigerian Conservation Foundation, deforestation rates in Nigeria have been alarmingly high, with an estimated loss of 400,000 hectares of forest annually [21]. This poses a significant threat to the country's climate governance and policy frameworks. To address this issue, effective management strategies must be implemented. One approach is to establish protected areas and national parks to conserve forests and biodiversity. For instance, the Cross River National Park in Nigeria has been successful in conserving a diverse range of plant and animal species, including endangered ones like the Nigeria–Cameroonian chimpanzee. Additionally, community-based initiatives and partnerships with local stakeholders can play a crucial role in promoting sustainable forestry practices and raising awareness about the importance of preserving forests for future generations. These efforts can help mitigate deforestation rates and contribute to the overall environmental sustainability of Nigeria.

### *2.8. Investing in Green Infrastructure Projects*

Investing in green infrastructure projects, such as green buildings and renewable energy installations, not only helps reduce greenhouse gas emissions but also presents a significant opportunity for job creation and economic growth. According to a report by the Nigerian Investment Promotion Commission, the investment in green infrastructure projects in Nigeria has been steadily increasing over the years. In 2019 alone, the country witnessed a significant investment of USD 2.7 billion in renewable energy projects [21]. This demonstrates a growing commitment towards sustainable development and reducing carbon emissions in Nigeria.

By prioritizing these projects, Nigeria can tap into the potential of its renewable energy sector, attract investments, and create a skilled workforce specializing in sustainable technologies. This approach aligns with Nigeria's climate goals while simultaneously addressing unemployment and fostering long-term economic development. Investing in renewable energy installations can also help Nigeria diversify its energy sources, reducing its dependence on fossil fuels and increasing energy security. According to a report by the International Renewable Energy Agency (IRENA), Nigeria has made significant progress in transitioning to clean and sustainable energy sources. The country's renewable energy capacity has increased by 13% in recent years, with solar and wind power being the primary contributors [24]. Additionally, Nigeria aims to achieve 30% of its electricity generation from renewable sources by 2030, as outlined in its Nationally Determined Contributions

(NDCs) under the Paris Agreement [24]. This commitment highlights Nigeria's dedication to reducing its carbon footprint and mitigating the effects of climate change. Furthermore, the government has implemented various policies and incentives to attract investments in renewable energy projects, fostering a conducive environment for growth in the sector. These efforts not only contribute to Nigeria's sustainable development goals but also position the country as a major player in the global transition to clean and sustainable energy.

Investing in renewable energy can also have positive environmental impacts by reducing greenhouse gas emissions and mitigating the effects of climate change. This can contribute to a healthier and more sustainable future for Nigeria and its citizens. The development of renewable energy infrastructure can create job opportunities and stimulate local economies, providing a boost to employment rates and overall prosperity. Moreover, transitioning to renewable energy sources can also enhance Nigeria's energy security. By diversifying its energy mix and reducing its dependence on fossil fuels, the country can become less vulnerable to fluctuations in global oil prices and geopolitical tensions. Nigeria heavily relies on oil exports, which account for a significant portion of its revenue and foreign exchange earnings. According to the World Bank, oil exports contribute around 90% of Nigeria's total export earnings [29]. This heavy dependence on oil makes Nigeria highly vulnerable to oil price fluctuations in the global market. When oil prices decline, Nigeria's economy faces several challenges. Firstly, it experiences a decrease in government revenue, leading to budget deficits and reduced funding for critical sectors such as healthcare, education, and infrastructure development. This can have a detrimental impact on the overall well-being of the population and hinder the country's long-term growth prospects. Additionally, the decline in oil prices can also lead to job losses and increased unemployment rates, further exacerbating socio-economic inequalities within Nigeria. Therefore, diversifying the economy and reducing its reliance on oil exports become crucial for Nigeria to build a more resilient and sustainable economic future. Investing in renewable energy technologies can foster innovation and attract foreign investment, positioning Nigeria as a leader in the global clean energy transition. Furthermore, transitioning to renewable energy sources can also have significant environmental benefits for Nigeria. By reducing greenhouse gas emissions and air pollution, the country can mitigate the impacts of climate change and improve public health. Promoting the use of renewable energy can create new job opportunities and stimulate economic growth in the renewable energy sector, contributing to a more sustainable and inclusive economy for Nigeria.

### *2.9. Supporting Research and Development of Clean Energy Technologies*

According to a report by the International Renewable Energy Agency (IRENA), Nigeria has made significant progress in supporting research and development (R&D) of clean energy technologies. The report highlights that the Nigerian government has allocated a budget of USD 30 million towards R&D initiatives in the renewable energy sector [24]. Additionally, partnerships with international organizations such as the United Nations Development Programme (UNDP) and the World Bank have provided further financial support for clean energy R&D projects in Nigeria. According to a report by the International Renewable Energy Agency (IRENA), Nigeria has made significant progress in supporting research and development of clean energy technologies. The country has witnessed a steady increase in investments in renewable energy, with a 50% growth recorded in 2019 alone [24]. Furthermore, the Nigerian government has established various initiatives and policies to promote clean energy innovation, such as the Renewable Energy Master Plan and the Nigerian Electricity Regulatory Commission's Feed-in Tariff program [24]. These initiatives aim to attract both domestic and foreign investments in the clean energy sector and create a conducive environment for research and development in Nigeria. Additionally, the government has also implemented capacity building programs to enhance the skills and knowledge of professionals working in the clean energy industry, further supporting the growth of clean energy technologies in the country.

Supporting research and development of clean energy technologies is crucial for Nigeria to achieve its climate goals. This approach is based on the understanding that investing in innovative solutions can lead to the development of more efficient and affordable clean energy sources. Research and development can help address the specific challenges and opportunities that Nigeria faces in transitioning to a low-carbon economy, such as leveraging its abundant renewable resources like solar and wind power. According to a study conducted by the Nigerian Electricity Regulatory Commission (NERC), solar and wind power have shown significant potential in Nigeria. The study estimates that Nigeria has an average solar radiation of about 3.5–7 kWh/m<sup>2</sup>/day [21], making it suitable for solar power generation. Additionally, the country has wind speeds ranging from 3 to 8 m/s in various regions, which is considered ideal for wind power projects. Furthermore, a report by the International Renewable Energy Agency (IRENA) states that Nigeria has the potential to generate over 3000 megawatts of electricity from solar power alone [24]. This highlights the immense opportunity for renewable energy development in the country and the potential to reduce its reliance on fossil fuels. By investing in research and development, Nigeria can not only reduce its dependence on fossil fuels but also create new job opportunities and stimulate economic growth. Research and development can also drive innovation in energy storage technologies, which are crucial for ensuring the reliability and scalability of renewable energy sources. Energy storage technologies play a critical role in ensuring a reliable and efficient energy supply. According to the International Renewable Energy Agency (IRENA), energy storage can help address the challenges associated with intermittent renewable energy sources, such as solar and wind power [24]. By storing excess energy during periods of high generation and releasing it during times of low generation, energy storage systems can enhance grid stability and reduce reliance on fossil fuel-based backup power. In Nigeria, where access to electricity remains a significant challenge, energy storage technologies can have a transformative impact. By utilizing energy storage systems, Nigeria can optimize the use of intermittent renewable energy sources and provide reliable electricity to remote areas. This can not only improve the quality of life for its citizens but also contribute to the country's sustainable development goals.

Investing in research and development can foster collaborations with international partners, allowing Nigeria to benefit from global expertise and accelerate its clean energy transition. Investing in research and development can also lead to technological advancements and cost reductions in energy storage systems, making them more accessible and affordable for both urban and rural areas in Nigeria. This would not only improve energy access but also create opportunities for job creation and economic growth in the renewable energy sector. By collaborating with international partners, Nigeria can tap into its knowledge and experience in renewable energy technologies, such as solar and wind power. This exchange of expertise can help Nigeria overcome technical challenges and ensure the successful implementation of clean energy projects across the country. Investing in research and development can drive innovation in renewable energy solutions tailored to Nigeria's unique needs, such as off-grid systems for remote communities or efficient microgrids for urban centers. These advancements would not only contribute to a more sustainable energy landscape but also create opportunities for job creation and economic growth. By investing in renewable energy, Nigeria can reduce its dependence on fossil fuels and mitigate the negative impacts of climate change. According to the International Renewable Energy Agency (IRENA), Nigeria has a vast potential for renewable energy generation, particularly in solar and wind power [24]. For instance, the country receives an average of 6.1 kWh/m<sup>2</sup> of solar radiation per day, making it suitable for large-scale solar projects [21]. Additionally, Nigeria's northern region has high wind speeds, reaching up to 7 m per second, which presents an opportunity for wind power development. Tailoring renewable energy projects to Nigeria's abundant solar and wind resources can not only help meet the country's growing energy demands but also reduce its reliance on fossil fuels. This transition to renewable energy sources can contribute to a cleaner environment, create job opportunities, and stimulate economic growth in Nigeria.

The development of clean energy infrastructure can improve access to electricity in rural areas, providing a better quality of life for communities that currently lack reliable power sources. In addition, the transition to renewable energy sources can also enhance energy security for Nigeria and reduce the negative impacts of climate change, as it reduces the country's vulnerability to fluctuations in global oil prices. By diversifying its energy sources and reducing reliance on fossil fuels, Nigeria can not only reduce greenhouse gas emissions but also decrease its exposure to volatile oil markets. This transition to renewable energy can also create new job opportunities and stimulate economic growth in the country. Investing in clean energy infrastructure can help Nigeria meet its commitments under the Paris Agreement and contribute to global efforts to combat climate change.

#### *2.10. Collaborating with Other Countries to Establish International Agreements*

Collaborating with other countries to establish international agreements and targets for reducing greenhouse gas emissions is crucial for Nigeria to effectively address climate change. Collaborating with other countries to establish international agreements is a crucial aspect of Nigeria's foreign policy. It allows the country to actively participate in global initiatives and address various challenges that require collective action. For instance, Nigeria has been actively involved in international agreements such as the Paris Agreement on climate change, where it has committed to reducing greenhouse gas emissions by 20% by 2030 [21]. Additionally, Nigeria is a signatory to the United Nations Convention against Corruption (UNCAC), demonstrating its commitment to combating corruption both domestically and internationally. By participating in these global initiatives, Nigeria not only strengthens its reputation as a responsible and accountable nation but also contributes to the overall stability and development of the international community.

By working together on a global scale, countries can share knowledge, resources, and technologies to accelerate the transition towards a low-carbon economy. International agreements play a crucial role in providing a framework for accountability and ensuring commitment from all nations to mitigate climate change in Nigeria. One such agreement is the Paris Agreement, which has been ratified by 189 countries, including Nigeria [24]. This agreement sets specific targets and commitments for countries to reduce greenhouse gas emissions and adapt to the impacts of climate change. The Paris Agreement also establishes a robust transparency framework that requires countries to regularly report on their emissions and progress towards their targets [24]. This transparency framework helps to hold countries accountable and ensures that they are taking meaningful actions to address climate change. Additionally, the Paris Agreement provides financial support to developing countries like Nigeria to help them transition to a low-carbon economy and build resilience against climate impacts. This financial assistance is crucial for Nigeria as it faces numerous challenges in addressing climate change, including limited resources and infrastructure. Additionally, such collaborations foster diplomatic relations and promote a sense of shared responsibility for tackling this global challenge. Collaborations play a crucial role in facilitating the pooling of financial resources for developing countries like Nigeria to access funding and support for their climate change initiatives. According to a report by the United Nations Environment Programme (UNEP), partnerships between developed and developing countries have been instrumental in mobilizing significant financial resources for climate action in Nigeria [21]. For instance, the Green Climate Fund, established under the United Nations Framework Convention on Climate Change, has provided substantial financial support to Nigeria through collaborative efforts with various international organizations and governments. This funding has enabled Nigeria to implement projects aimed at reducing greenhouse gas emissions, promoting renewable energy sources, and enhancing climate resilience. By addressing climate change collectively, countries can also leverage their collective bargaining power to negotiate more ambitious emission reduction targets and encourage greater participation from all nations.

International collaboration on climate change initiatives can foster knowledge sharing and technology transfer between countries. This exchange of expertise can accelerate the



development and implementation of innovative solutions to mitigate the impacts of climate change. By working together, countries can pool their resources to invest in research and development, leading to breakthroughs in renewable energy technologies and other sustainable practices. This can ultimately lead to a more sustainable and resilient global economy, as countries can collectively address the challenges posed by climate change. Moreover, international collaboration can also help create a sense of shared responsibility and commitment towards tackling climate change, fostering a stronger global community dedicated to preserving the planet for future generations.

International collaboration can also enhance the effectiveness of climate change policies and agreements. By coordinating efforts and sharing best practices, countries can ensure that their actions are aligned and mutually reinforcing, maximizing the overall impact of their initiatives. This collective approach can create a stronger global response to climate change, increasing the chances of achieving long-term sustainability goals and protecting future generations from its detrimental effects. Furthermore, collaboration allows for the pooling of resources and expertise, enabling countries to tackle climate change on a larger scale. By working together, nations can leverage their combined knowledge and financial capabilities to implement innovative solutions and technologies that may be beyond the reach of individual countries. This collaborative approach not only fosters international cooperation but also fosters a sense of shared responsibility in addressing the urgent global issue of climate change.

Collaboration among countries promotes knowledge sharing and the exchange of best practices, allowing for more efficient and effective climate change mitigation and adaptation strategies. This collaborative approach can lead to the development of global standards and policies that ensure consistency in addressing climate change across borders, ultimately leading to a more coordinated and impactful response to this pressing issue. International collaboration fosters a sense of collective responsibility and encourages countries to hold each other accountable for their actions in combating climate change. By working together, nations can leverage their resources and expertise to implement large-scale initiatives that have a greater chance of success in reducing greenhouse gas emissions and minimizing the negative impacts of climate change. This collaborative effort also sends a powerful message to the global community, demonstrating that addressing climate change requires collective action and solidarity among nations.

Public-private partnerships also play a crucial role in collaboration to combat climate change in Nigeria. According to a study conducted by [21], these partnerships have significantly contributed to the implementation of sustainable development projects and the reduction of greenhouse gas emissions in the country. Furthermore, these collaborations have also fostered knowledge sharing and technology transfer, allowing Nigeria to benefit from the expertise and experience of international partners. This has not only accelerated the country's progress towards sustainable development goals but has also enhanced its capacity to address climate change challenges effectively.

This collaborative effort fosters innovation and knowledge sharing, as nations can learn from each other's successes and failures in tackling climate change. By holding each other accountable, nations can ensure that they stay committed to their climate goals and continuously strive for improvement. This united front not only strengthens the effectiveness of individual actions but also inspires other countries to join the fight against climate change, creating a domino effect towards a more sustainable future. The collaboration between nations promotes the development and implementation of new technologies and strategies to combat climate change. This exchange of ideas and expertise can lead to breakthrough innovations that can significantly accelerate the transition to a low-carbon economy. By working together, nations can pool their resources and share the financial burden of implementing large-scale climate initiatives, making it more feasible for countries with limited resources to take meaningful action. Leading in climate change mitigation can bring significant geopolitical benefits for Nigeria. Firstly, it would enhance Nigeria's international reputation and influence. By actively taking measures to reduce

greenhouse gas emissions and promote sustainable development, Nigeria can position itself as a responsible global actor committed to addressing one of the most pressing challenges of our time. This could lead to increased diplomatic leverage and partnerships with other nations, potentially opening doors for economic collaborations and foreign investments. International collaboration allows for the sharing of best practices and lessons learned, enabling countries to avoid repeating mistakes and instead build upon successful approaches. By fostering cooperation and coordination among nations, global climate agreements can create a sense of collective responsibility and urgency, motivating countries to set ambitious targets and take bold actions to address climate change.

### *2.11. Educating the Public about the Importance of Sustainable Practices*

Educating the public about sustainable practices and encouraging environmentally friendly behaviors is crucial for Nigeria to achieve its climate goals. According to a recent study by the Nigerian Conservation Foundation, only 25% of the population is aware of sustainable practices and their importance to the environment [30]. This highlights the urgent need for effective education campaigns to increase public awareness. Additionally, a report by the United Nations Development Programme emphasizes that educating the public about sustainable practices can lead to positive behavioral changes and contribute to achieving Nigeria's Sustainable Development Goals. By implementing effective educational campaigns and workshops, we can raise awareness among the remaining 70% of the population and encourage them to adopt sustainable practices in their daily lives.

By raising awareness about the importance of sustainability, individuals can make informed choices that reduce their carbon footprint and contribute to a greener future. This approach not only empowers citizens to take responsibility for their actions but also fosters a collective effort towards achieving a more sustainable Nigeria. Educating the public about sustainable practices can also lead to economic benefits for Nigeria. By promoting green industries and encouraging sustainable business practices, the country can create new job opportunities and stimulate economic growth. Investing in renewable energy sources and promoting energy efficiency can help Nigeria reduce its dependence on fossil fuels and mitigate the negative impacts of climate change on its economy and natural resources.

Adopting sustainable practices can enhance Nigeria's global reputation and attract foreign investment. By showcasing a commitment to environmental stewardship, the country can position itself as an attractive destination for environmentally conscious businesses and investors. This can further contribute to the country's economic development and overall prosperity. Transitioning to sustainable practices can also lead to job creation and economic diversification. By investing in renewable energy sources such as solar and wind power, Nigeria can reduce its reliance on fossil fuels and create new opportunities in the green energy sector. This not only helps to address climate change but also stimulates economic growth by tapping into the potential of clean technologies. Adopting sustainable practices can attract foreign investment and strengthen Nigeria's position in the global market. Many countries and international organizations prioritize environmentally friendly initiatives, and by demonstrating a commitment to sustainability, Nigeria can enhance its reputation and attract partnerships that can further boost its economic development.

Investing in clean technologies can also lead to cost savings in the long run, as renewable energy sources are often more affordable and reliable than traditional fossil fuels. Embracing sustainability can also help Nigeria mitigate the adverse effects of climate change, such as extreme weather events and rising sea levels. By transitioning to clean energy and reducing carbon emissions, Nigeria can contribute to global efforts to combat climate change and safeguard the environment for future generations. Embracing sustainability can also stimulate economic growth and create new job opportunities in Nigeria's renewable energy sector. By investing in clean energy technologies and infrastructure, the country can attract foreign investments and foster a sustainable and resilient economy. Transitioning to renewable energy sources can reduce Nigeria's dependence on imported

fossil fuels, enhance energy security, and reduce vulnerability to fluctuations in global oil prices.

In addition to renewable energy, Nigeria has immense potential for the growth of its agriculture and tourism sectors. According to a report by the World Bank, agriculture contributes to about 24% of Nigeria's GDP and employs approximately 70% of the population [29]. With favorable climatic conditions and vast arable land, the country can further harness its agricultural resources to enhance food security, increase exports, and boost rural development. Furthermore, Nigeria's rich cultural heritage and diverse natural landscapes make it a promising destination for tourism, which has the potential to generate significant revenue and create employment opportunities. The country is home to numerous historical sites, vibrant festivals, and breathtaking natural attractions such as wildlife reserves and beautiful beaches. By investing in infrastructure, promoting sustainable tourism practices, and showcasing its unique cultural offerings, Nigeria can attract more international tourists and stimulate economic growth in the sector.

According to a study conducted by the International Renewable Energy Agency (IRENA), Nigeria has significant potential for renewable energy sources such as solar, wind, and hydropower. The study estimates that Nigeria could generate up to 3500 megawatts of electricity from solar power alone [24]. Additionally, Nigeria's coastal regions have immense potential for harnessing wind energy, with wind speeds averaging around 7 m per second. Furthermore, a report by the World Bank highlights the potential of biomass energy in Nigeria. The report states that Nigeria has abundant biomass resources, including agricultural waste and forestry residues, which can be converted into bioenergy. This could provide a sustainable and reliable source of energy for rural communities and contribute to reducing greenhouse gas emissions. Moreover, the report emphasizes the importance of investing in renewable energy infrastructure and policies to unlock Nigeria's full potential in the renewable energy sector.

One way energy security can make Nigeria less vulnerable to external economic pressures is by reducing its dependence on imported energy sources. Currently, Nigeria relies heavily on imported petroleum products to meet its energy needs. By diversifying its energy mix and investing in renewable energy sources such as solar and wind power, Nigeria can decrease its reliance on imports and enhance its energy security. Moreover, sustainable practices can also contribute to Nigeria's resilience against external economic pressures. Implementing energy-efficient technologies and promoting sustainable consumption patterns can help reduce the country's overall energy demand and dependence on imported petroleum products. This not only decreases the strain on Nigeria's economy but also mitigates the environmental impact caused by fossil fuel consumption. Additionally, investing in renewable energy sources can create job opportunities and stimulate economic growth within the country, further strengthening Nigeria's energy security and overall sustainability.

#### *2.12. Implementing Stricter Regulations and Standards for Industries*

Implementing stricter regulations and standards for industries is crucial to reducing their carbon footprint and promoting sustainable production processes. Implementing stricter regulations and standards for industries in Nigeria is crucial for several reasons. Firstly, it can significantly reduce the negative environmental impact caused by industrial activities. According to a study conducted by the Nigerian Conservation Foundation (NCF), the current lack of stringent regulations has led to widespread pollution of air, water, and soil, posing serious health risks to both humans and wildlife [29]. Secondly, enforcing stricter standards can enhance the overall quality of products manufactured in Nigeria, ensuring they meet international standards and are competitive in the global market. This can lead to increased exports and foreign investment, ultimately boosting the country's economy. Additionally, implementing stricter regulations can also promote innovation and the development of cleaner technologies, as industries will be compelled to find more sustainable ways of production.

By setting clear guidelines and targets, Nigeria can ensure that industries adopt cleaner technologies, improve energy efficiency, and reduce greenhouse gas emissions. In order to implement stricter regulations and standards for industries in Nigeria, it is crucial to focus on technologies and practices that promote sustainability, efficiency, and environmental protection. One key area of focus should be the adoption of renewable energy sources such as solar, wind, and hydropower. These technologies not only reduce greenhouse gas emissions but also provide a reliable and cost-effective alternative to fossil fuels. Additionally, investing in cleaner production processes and waste management systems can significantly improve industry practices in Nigeria. For instance, implementing advanced waste-to-energy systems can help convert waste into usable energy, reducing reliance on landfills and minimizing environmental pollution. Furthermore, incorporating circular economy principles, such as recycling and reusing materials, can contribute to a more sustainable and resource-efficient industrial sector in Nigeria. This approach not only aligns with Nigeria's climate goals but also encourages the transition towards a greener economy, fosters innovation, and creates new job opportunities in the renewable energy sector. Implementing these guidelines and targets can help Nigeria attract foreign investments and partnerships in the clean energy sector. This can lead to technology transfer and knowledge sharing, ultimately accelerating the country's transition to a low-carbon economy. By showcasing its commitment to sustainable production processes, Nigeria can position itself as a leader in environmental stewardship and inspire other countries to follow suit. One way Nigeria can leverage its regional influence to bring other African countries on board with sustainability efforts is by showcasing its own successful sustainability initiatives and their positive impact. For instance, Nigeria can highlight the success of its renewable energy projects, such as the implementation of solar power systems in rural areas that have improved access to electricity for communities. By providing concrete figures and data on the economic and social benefits derived from these initiatives, Nigeria can serve as a role model for other African countries, inspiring them to adopt similar sustainable practices. Additionally, Nigeria can showcase its efforts in waste management and recycling programs, which have contributed to reducing environmental pollution and promoting a circular economy. These initiatives not only benefit the environment but also create employment opportunities and stimulate economic growth in the country. By sharing these success stories, Nigeria can encourage other African nations to prioritize sustainability and work towards a greener future for the continent. By embracing renewable energy, Nigeria can also reduce its dependence on fossil fuels and improve energy security. This shift towards clean energy sources can contribute to a more stable and resilient energy infrastructure, ensuring a reliable and sustainable power supply for its growing population.

By reducing greenhouse gas emissions through the adoption of renewable energy, Nigeria can play a significant role in global efforts to mitigate climate change and protect the planet for future generations. Transitioning to clean energy sources not only benefits Nigeria's energy security and environmental sustainability but also presents economic opportunities. The development of renewable energy industries can create jobs, attract foreign investments, and stimulate economic growth. Additionally, by diversifying its energy mix, Nigeria can better withstand fluctuations in global oil prices and reduce the vulnerability of its economy to oil market volatility. Investing in clean energy technologies can help Nigeria reduce its greenhouse gas emissions and contribute to global efforts to combat climate change. In addition to addressing vulnerability to oil prices, diversification can help mitigate various other economic risks in Nigeria. One significant risk is overdependence on a single sector, which leaves the economy susceptible to fluctuations in that sector. For instance, according to a report by the Nigerian Bureau of Statistics, the oil sector accounted for over 90% of Nigeria's total export earnings in 2020 [21]. Such heavy reliance on one industry exposes the economy to external shocks and market volatility. Diversification can help reduce this vulnerability by promoting the development of other sectors such as agriculture, manufacturing, and services. By expanding the economic base and creating multiple sources of income, Nigeria can better withstand the impact of any downturns

or disruptions in the oil sector. Additionally, diversification can also lead to job creation, increased productivity, and improved living standards for the population as a whole. This transition can also improve the health and well-being of Nigerian citizens by reducing air pollution caused by traditional fossil fuel combustion.

By embracing clean energy, Nigeria can position itself as a leader in sustainable development and inspire other nations to follow suit. Transitioning to clean energy can also diversify Nigeria's economy and reduce its dependence on oil, making it more resilient to future oil market fluctuations. Investing in renewable energy sources can create new job opportunities and stimulate economic growth in a country. Adopting clean energy technologies can improve public health by reducing the harmful emissions that contribute to respiratory diseases and other health issues. According to a study conducted by the World Health Organization (WHO), air pollution in Nigeria is a significant concern, particularly in urban areas. The study estimates that outdoor air pollution causes approximately 150,000 premature deaths annually in the country [29]. However, there is hope for improvement. The Nigerian government has implemented several measures to address air pollution, such as the National Clean Air Program and stricter regulations on industrial emissions. Projections suggest that if these efforts are effectively enforced and sustained, Nigeria could see a significant reduction in air pollution levels. Additionally, public awareness campaigns and education programs can play a crucial role in promoting sustainable practices and encouraging individuals to adopt cleaner and greener lifestyles. Transitioning to renewable energy sources can help Nigeria meet its commitments under the Paris Agreement and contribute to global efforts to combat climate change.

### **3. Possible Scenario for Nigeria's Path to Achieving Its Climate Goals More Quickly**

The likelihood that Nigeria will move closer to achieving its climate goals more quickly depends on a number of factors, including governmental policies and regulations, international collaborations, technological advancements, and public participation and awareness. These twelve credible scenarios for meeting the climate goals developed in this study provide a range of potential pathways for Nigeria to achieve climate goals more quickly. However, which of these twelve credible scenarios for meeting the climate goals developed in this study (see Section 2) will help Nigeria get to climate goals more quickly? Implementing stricter regulations and standards for industries to reduce their carbon footprint and promote sustainable production processes will likely help Nigeria get to climate goals more quickly due to the following reasons: 1. Mitigating environmental degradation: By enforcing stricter regulations, industries will be compelled to adopt cleaner technologies and practices, reducing their emissions of greenhouse gases. This will help mitigate environmental degradation, such as air pollution and deforestation, which contribute to climate change. 2. Encouraging innovation and investment: Stricter regulations can drive industries to invest in research and development of clean energy technologies. This will not only lead to the creation of new job opportunities but also attract foreign investment in Nigeria's renewable energy sector. Additionally, promoting innovation can help Nigeria become a leader in sustainable practices and technologies, further accelerating its progress toward climate goals. 3. Improving energy efficiency: Implementing measures to increase energy efficiency in buildings, transportation, and industrial processes can significantly reduce greenhouse gas emissions. This can be achieved through the adoption of energy-efficient technologies, such as LED lighting and fuel-efficient vehicles, as well as promoting energy conservation practices among individuals and businesses. By reducing the overall demand for energy, Nigeria can lessen its reliance on fossil fuels and mitigate the impact of climate change. 4. Implementing sustainable land management practices: Adopting sustainable land management practices, such as reforestation and soil conservation, can help mitigate climate change by sequestering carbon dioxide and preserving biodiversity. These practices can also enhance the resilience of Nigeria's ecosystems, protecting them from the impacts of climate change such as droughts and floods. Moreover, sustainable land management can provide additional benefits like improved water quality and increased agricultural

productivity. 5. Improving infrastructure and transportation: Investing in sustainable infrastructure and improving public transportation systems can reduce greenhouse gas emissions from vehicles. This can be achieved by implementing measures such as expanding electric vehicle charging stations, promoting the use of public transportation, and developing bike lanes and pedestrian-friendly infrastructure. These efforts will not only help combat climate change but also improve air quality and reduce traffic congestion in Nigeria's cities.

Nigeria can significantly reduce its greenhouse gas emissions and accelerate the transition towards a low-carbon economy by strengthening climate governance and policy frameworks. Investing in renewable energy sources like solar and wind power can provide economic opportunities and energy security for the country while promoting public awareness and education about sustainable practices can foster a culture of environmental responsibility. This can help reduce Nigeria's reliance on fossil fuels and diversify its energy portfolio, mitigating the risks associated with fluctuating oil prices and creating job opportunities in the renewable energy sector. Integrating sustainable practices into industries such as agriculture and transportation can further contribute to Nigeria's transition to climate goals. Investing in clean energy technologies can attract foreign investments and promote sustainable economic growth, positioning Nigeria as a global leader in the green energy market. Implementing energy-efficient practices and promoting energy conservation among industries and households can further reduce Nigeria's carbon footprint. The government can play a crucial role by implementing supportive policies and providing incentives for the adoption of clean energy solutions. Fostering international collaborations and partnerships can facilitate knowledge exchange and help Nigeria access resources and expertise needed for the development of its renewable energy sector. Reducing Nigeria's dependence on imported fossil fuels can redirect resources towards other sectors, leading to overall socio-economic development.

#### **4. Scenarios Could Hinder Nigeria's Advancement toward Its Climate Goals**

Possible scenarios that could impede Nigeria's progress toward its climate goals developed in this study are dependent on a variety of factors, including the country's level of commitment to implementing climate policies, the availability and adoption of clean energy technologies, the pace of economic development, and the ability to attract international investments for sustainable projects. Additionally, factors such as political stability, social acceptance of renewable energy, and the capacity to address potential challenges like infrastructure development and job creation will also play a crucial role in determining Nigeria's ability to achieve climate goals more quickly. These factors are interconnected and must be addressed holistically to ensure a successful transition towards net zero emissions.

Which of these scenarios will militate against Nigeria getting to climate goals more quickly? The scenario that is likely to militate against Nigeria getting to climate goals more quickly is the lack of implementation and enforcement of stricter regulations and standards for industries due to the following reasons. 1. Stricter vehicle emission standards are one innovative regulation that could be implemented in Nigeria's automotive sector. By setting lower limits on the amount of carbon emissions allowed, this regulation would encourage manufacturers to produce more fuel-efficient and environmentally friendly vehicles. Additionally, promoting the adoption of electric vehicles through incentives and subsidies could further reduce the carbon footprint of the automotive industry in Nigeria. 2. Carbon pricing mechanisms are one novel regulation that can be implemented in Nigeria's manufacturing industry. By imposing a price on carbon emissions, manufacturers will be incentivized to reduce their carbon footprint and invest in cleaner production processes. Additionally, the government can introduce standards and incentives for manufacturers to adopt renewable energy sources such as solar or wind power, further promoting sustainable production practices in Nigeria. 3. The requirement to power construction sites and buildings with renewable energy is an innovative regulation that can be implemented in

Nigeria's construction sector. This would not only reduce their carbon footprint but also promote sustainable production processes. Additionally, introducing strict guidelines for waste management and recycling within the construction industry can further contribute to reducing their environmental impact and promoting sustainability in Nigeria. 4. The establishment of carbon pricing mechanisms is one novel regulation that can be applied to Nigeria's agricultural sector. This would involve placing a price on carbon emissions generated by agricultural activities and incentivizing farmers to adopt more sustainable practices and invest in low-carbon technologies. Additionally, promoting the use of renewable energy sources such as solar power in agricultural operations can further reduce the industry's carbon footprint and contribute to sustainable production processes.

Without effective measures in place, industries may continue to contribute significantly to the country's carbon footprint, hindering progress towards sustainable production processes. Additionally, if climate governance and policy frameworks are not strengthened, it may be challenging to coordinate and prioritize actions necessary for achieving climate goals in a timely manner. This lack of implementation and enforcement can lead to detrimental consequences for the environment, as industries may continue to emit harmful pollutants [34] and exacerbate climate change [35]. Without stricter regulations and standards, it becomes difficult to hold industries accountable for their environmental impact [36] and encourage them to adopt cleaner and more sustainable practices. The absence of incentives and penalties for companies that fail to adopt sustainable practices can further perpetuate the problem. It is crucial for governments to incentivize and reward industries that actively reduce their carbon emissions while also imposing penalties on those who do not comply with environmental regulations. By doing so, there will be greater motivation for industries to prioritize sustainability and work towards achieving net zero emissions. Governments should also invest in the research and development of clean technologies and provide financial support to companies that are developing innovative solutions for reducing carbon emissions. This will not only encourage the adoption of sustainable practices but also foster technological advancements that can drive the transition to a greener economy. Ultimately, a comprehensive approach that combines incentives, penalties, and investments is necessary to effectively address the climate crisis and ensure a sustainable future for all. In addition, governments should also prioritize the implementation of regulations and policies that promote the use of renewable energy sources and discourage reliance on fossil fuels. Creating a favorable regulatory environment will incentivize businesses and individuals to transition towards cleaner energy alternatives, further accelerating the shift towards a greener economy. International collaboration and cooperation are crucial in tackling the global nature of climate change, as countries can share knowledge, resources, and best practices to collectively combat this pressing issue. Investing in research and development of new technologies will play a vital role in finding innovative solutions to reduce greenhouse gas emissions. This can lead to the discovery of more efficient and cost-effective renewable energy sources, making them more accessible to a wider population. Educating the public about the benefits of renewable energy and the consequences of continued reliance on fossil fuels can help create widespread understanding and support for transitioning towards a sustainable future. By investing in research and development, we can accelerate the progress of renewable energy technologies and make them even more advanced and reliable. Government policies that incentivize the adoption of clean energy sources can further drive the transition toward a sustainable future by encouraging businesses and individuals to make environmentally friendly choices. Educating the public about the benefits of renewable energy and its positive impact on the environment can play a crucial role in fostering widespread understanding and support. This can be achieved through awareness campaigns, educational programs, and partnerships with educational institutions to ensure that future generations are well-informed about the importance of transitioning toward sustainable energy sources. A combination of research and development, government policies, and public education can pave the way for a truly sustainable future. By investing in research and development, we can discover innovative technologies and solutions that

will further enhance the adoption of sustainable energy sources. Implementing effective government policies that incentivize businesses and individuals to prioritize sustainability can create a conducive environment for widespread change. Ultimately, it is through these collective efforts that we can pave the way for a truly sustainable future and mitigate the negative impacts of our current energy practices on the environment.

### **5. The Scenario Most Likely to Accelerate Nigeria's Progress toward the Proposed Zero Net by 2060**

A number of factors influence the scenario most likely to accelerate Nigeria's progress toward the proposed zero net by 2060, including the level of commitment and implementation of sustainable energy solutions, the availability of funding and investments in renewable energy projects, and the effectiveness of education and training programs to build a skilled workforce in the green sector. Additionally, cooperation and support from developed countries in terms of technology transfer and capacity building can also play a crucial role in expediting Nigeria's transition towards achieving its net zero goals. However, the likelihood that Nigeria will move closer to meeting its net zero goals more quickly can be determined based on the twelve proposed scenarios. These scenarios take into account various factors, such as policy implementation, investment in renewable energy infrastructure, and the adoption of sustainable practices in key sectors like agriculture and transportation. By carefully analyzing these scenarios, policymakers can identify the most effective strategies to accelerate Nigeria's progress towards its net zero goals. Regular monitoring and evaluation of the country's progress will be essential to ensuring that necessary adjustments are made along the way. Which of these scenarios is most likely to accelerate Nigeria's progress toward the proposed zero net by 2060?

Implementing stricter regulations and standards for industries to reduce their carbon footprint and promote sustainable production processes is the most likely scenario to accelerate Nigeria's progress toward the proposed zero net by 2060. This approach would ensure that industries are held accountable for their environmental impact and encourage them to adopt more sustainable practices, ultimately reducing Nigeria's overall carbon emissions. It would pave the way for a greener economy and set a precedent for other sectors to follow suit in mitigating climate change [37]. By implementing strict regulations and providing incentives for companies to invest in renewable energy sources, Nigeria can further incentivize sustainable production processes. This would not only reduce carbon emissions but also create new job opportunities in the renewable energy sector, contributing to economic growth and development.

International collaborations and partnerships can provide valuable knowledge sharing and financial support to help Nigeria achieve its zero net goal by 2060 [38]. Implementing effective waste management systems and promoting recycling initiatives can also contribute to Nigeria's sustainable production processes [39]. By reducing waste and promoting the reuse of materials, the country can minimize its environmental footprint and conserve valuable resources [40]. Investing in research and development for renewable energy technologies can drive innovation and position Nigeria as a leader in the global clean energy market [41].

Adopting sustainable agricultural practices can play a crucial role in Nigeria's journey towards sustainable production. By promoting organic farming methods and reducing the use of harmful pesticides and fertilizers, the country can protect its ecosystems and ensure food security for future generations. Educating and empowering local communities about the importance of sustainability can foster a culture of responsible consumption and further support Nigeria's sustainable production goals. Implementing efficient irrigation systems and adopting climate-smart techniques [42] can help mitigate the impact of climate change on agricultural productivity [43]. By utilizing water resources effectively and adapting to changing weather patterns, Nigeria can enhance its resilience to environmental challenges and maintain a sustainable food production system.



Promoting agroforestry practices and diversifying crop varieties can contribute to soil conservation, biodiversity preservation, and overall ecosystem health, ultimately strengthening Nigeria's journey towards sustainable production. Investing in research and development of climate-smart agricultural technologies can help Nigerian farmers mitigate the negative effects of climate change on their crops [44]. This can include the use of precision farming techniques, improved irrigation systems, and the development of drought-tolerant crop varieties. By implementing these strategies, Nigeria can not only increase its agricultural productivity but also reduce its greenhouse gas emissions and contribute to global efforts to combat climate change. Investing in climate-smart agricultural technologies can enhance the resilience of Nigerian farmers to extreme weather events, such as droughts and floods. This would enable them to adapt to changing climatic conditions and ensure food security for the growing population.

Promoting the adoption of these technologies can create employment opportunities and stimulate economic growth in rural areas, thereby improving livelihoods and reducing poverty levels. Moreover, climate-smart agricultural technologies can also contribute to reducing greenhouse gas emissions and mitigating climate change. By implementing sustainable farming practices and utilizing renewable energy sources, Nigerian farmers can minimize their carbon footprint [45] and contribute to global efforts to combat climate change [46]. The adoption of these technologies can attract investments and support sustainable development in the agricultural sector [47], leading to long-term economic benefits for the country [48].

The integration of advanced data analytics and precision farming techniques can optimize resource usage, improve crop yields, and reduce waste in Nigerian agriculture. This not only enhances the efficiency and profitability of farming operations but also helps preserve natural resources [49] and protect biodiversity [50]. By leveraging advanced data analytics and precision farming techniques, Nigeria can address key challenges in its agricultural sector. These technologies enable farmers to make data-driven decisions, such as optimizing irrigation schedules and applying fertilizers more precisely. This not only increases crop yields but also minimizes the environmental impact of farming practices. The adoption of these technologies can attract investment [51] and drive economic growth in rural areas, contributing to overall national development [52]. These farming technologies can also help improve food security by reducing post-harvest losses through better storage and transportation methods [33]. By implementing efficient supply chain management systems, farmers can ensure that their produce reaches the market in a timely manner, reducing spoilage and increasing access to nutritious food for the population.

The adoption of these technologies can also enhance the overall productivity of the agricultural sector in Nigeria. By utilizing advanced farming techniques and precision agriculture tools, farmers can optimize their crop yields and minimize resource waste. This not only improves their profitability but also contributes to the overall food security of the country, as more food can be produced to meet the growing demand. The integration of technology in agriculture can attract young entrepreneurs and professionals to engage in farming activities, thereby revitalizing the sector and creating new job opportunities. This can help address the issue of unemployment in Nigeria, especially among the youth population. The use of technology can also enhance the efficiency and effectiveness of farming practices, reducing the reliance on manual labor and increasing productivity. This can lead to a more sustainable and resilient agricultural sector in Nigeria, capable of adapting to climate change and other challenges.

The integration of technology in agriculture can improve access to market information and financial services for farmers. This can enable them to make informed decisions about pricing, crop selection, and investment opportunities, ultimately increasing their profitability and income. By embracing technological advancements in agriculture, Nigeria can attract more young people to the sector as it becomes seen as a modern and lucrative career option. The use of technology in agriculture can also enhance productivity and efficiency in farming practices. For instance, automated irrigation systems and precision

farming techniques can optimize water usage and minimize waste, leading to higher crop yields.

The implementation of smart farming technologies such as drones and sensors can help monitor crop health and detect diseases or pests early on, allowing for timely interventions and reducing crop losses. Moreover, the integration of artificial intelligence and data analytics in agriculture can provide valuable insights for farmers. By analyzing vast amounts of data, farmers can make informed decisions about planting schedules, fertilizer applications, and pest control measures. This not only improves crop quality but also reduces the environmental impact of farming practices. Ultimately, the use of technology in agriculture has the potential to revolutionize the industry and ensure sustainable food production for a growing global population.

## 6. Policy Implications

### 6.1. Increasing Renewable Energy Capacity

The implementation of feed-in tariffs is one novel policy idea that could be used to increase Nigeria's capacity for renewable energy. This policy would require the government to set a fixed price for renewable energy producers, guaranteeing them a certain rate of return on their investment. By providing financial incentives, this policy would attract more private investments in renewable energy projects, leading to an increase in capacity and a diversification of Nigeria's energy mix. Additionally, the government could establish a regulatory framework that simplifies the process of obtaining permits and licenses for renewable energy projects. This would streamline the bureaucratic procedures and reduce the time and effort required for developers to get their projects off the ground. Furthermore, the government could also collaborate with international organizations and experts to provide technical assistance and knowledge transfer, helping to build local capacity in renewable energy development and ensuring the successful implementation of projects.

### 6.2. Improving Energy Efficiency

Implementing an extensive program of energy audits could be one novel policy idea for enhancing energy efficiency in Nigeria. This program would involve conducting detailed assessments of energy usage and identifying areas where efficiency improvements can be made. Additionally, the policy could include incentives for businesses and households to adopt energy-efficient technologies and practices, such as offering tax breaks or subsidies for the purchase of energy-efficient appliances or the installation of renewable energy systems.

### 6.3. Promoting Sustainable Agriculture Practices

One innovative policy implication for promoting sustainable agriculture practices in Nigeria could be the implementation of a subsidy program that incentivizes farmers to adopt environmentally friendly farming techniques. This could include providing financial support or tax breaks to farmers who use organic fertilizers, practice crop rotation, or implement water conservation methods. Additionally, the government could invest in research and development to identify and promote sustainable farming technologies that can help increase productivity while minimizing environmental impact.

### 6.4. Enhancing Waste Management Systems

The introduction of an extensive recycling program might be one novel policy suggestion for improving Nigeria's waste management systems. This program could involve setting up recycling centers across the country and providing incentives for individuals and businesses to participate in recycling initiatives. Additionally, the government could invest in research and development to explore new technologies and methods for waste management, such as waste-to-energy conversion or decentralized waste treatment facilities. These measures would not only help reduce the amount of waste going to landfills but also create new job opportunities and contribute to a more sustainable and environmentally friendly economy. By promoting recycling and waste management, the government can

also educate the public about the importance of reducing, reusing, and recycling materials, leading to a shift in consumer behavior towards more sustainable practices. Furthermore, implementing stricter regulations on waste disposal and encouraging manufacturers to adopt eco-friendly packaging can also play a crucial role in minimizing waste generation and promoting a circular economy.

#### *6.5. Implementing Green Transportation Solutions*

The introduction of financial incentives for individuals and businesses to adopt eco-friendly modes of transportation could be one innovative policy implication for implementing green transportation solutions in Nigeria. This could include offering tax breaks or subsidies for purchasing electric vehicles or investing in renewable energy sources for transportation. Additionally, implementing a comprehensive public transportation system that prioritizes electric buses or trains could encourage more people to rely on greener alternatives, reducing the overall carbon footprint of the country's transportation sector.

#### *6.6. Adopting Circular Economy Principles*

The establishment of a national resource recovery and recycling program is one novel policy implication of adopting circular economy principles in Nigeria. This program could incentivize and support businesses to implement sustainable waste management practices, such as recycling and upcycling, to minimize waste generation and maximize resource efficiency. Additionally, the government could introduce tax incentives or subsidies for companies that adopt circular economy practices, encouraging more businesses to transition towards a more sustainable and circular model of production and consumption.

#### *6.7. Strengthening Climate Governance and Policy Frameworks*

A national carbon pricing mechanism is one innovative policy implication for strengthening climate governance and policy frameworks in Nigeria. This would involve implementing a carbon tax or a cap-and-trade system, which would incentivize industries and individuals to reduce their greenhouse gas emissions. Additionally, the revenue generated from this mechanism could be used to fund climate change mitigation and adaptation projects, such as renewable energy development and sustainable agriculture practices. Additionally, the government could create a dedicated fund to support research and development of renewable energy sources, promoting the transition towards a low-carbon economy. These measures would not only help Nigeria meet its climate targets but also stimulate economic growth and job creation in the renewable energy sector.

#### *6.8. Investing in Green Infrastructure Projects to Create Jobs and Stimulate Economic Growth*

Making a significant investment in green infrastructure projects in Nigeria has innovative policy implications, including the need to create a robust program for skill development. This program can focus on equipping the local workforce with the necessary knowledge and expertise to participate in the construction, maintenance, and operation of green buildings and renewable energy installations. By investing in human capital, Nigeria can ensure a sustainable pipeline of skilled workers who can contribute to the growth of the green infrastructure sector while also addressing unemployment challenges. Additionally, incorporating incentives such as tax breaks or subsidies for companies and individuals who invest in green building and renewable energy projects can further encourage participation in the sector. These incentives can help offset the initial costs associated with implementing sustainable practices and technologies, making them more accessible to a wider range of stakeholders. Furthermore, creating partnerships between government agencies, educational institutions, and industry leaders can facilitate the development of comprehensive training programs that cater to the specific needs of the green infrastructure sector.

#### *6.9. Supporting Research and Development of Clean Energy Technologies in Nigeria*

Establishing a dedicated fund for clean energy innovation is one innovative policy implication for supporting research and development of clean energy technologies in Nigeria. This fund could be sourced from both the public and private sectors, with the aim of providing financial support to researchers, entrepreneurs, and startups working on developing and commercializing clean energy technologies. Additionally, the policy could include provisions for collaboration between academia, industry, and government agencies to foster knowledge sharing and accelerate the adoption of clean energy solutions in Nigeria.

#### *6.10. Collaborating with Other Countries to Establish International Agreements and Targets for Reducing Greenhouse Gas Emissions on a Global Scale in Nigeria*

Prioritizing technology transfer and capacity building is one creative policy outcome of Nigeria's cooperation with other nations to create international agreements and goals for reducing greenhouse gas emissions on a global scale. By partnering with countries that have advanced technologies and expertise in renewable energy, Nigeria can accelerate its transition towards cleaner energy sources and reduce its reliance on fossil fuels. Additionally, fostering international collaborations can create opportunities for knowledge exchange and skill development, enabling Nigeria to build a skilled workforce capable of driving sustainable development in the country.

#### *6.11. Educating the Public about the Importance of Sustainable Practices and Encouraging Them to Adopt Environmentally Friendly Behaviors in Their Daily Lives*

The adoption of a thorough environmental education curriculum in schools could be one creative policy idea for sensitizing the populace about the value of sustainable practices and promoting environmentally friendly behaviors in Nigeria. This curriculum can include topics such as climate change, waste management, renewable energy, and conservation practices. Additionally, partnerships can be formed with local environmental organizations and experts to provide hands-on learning experiences and workshops for students. By integrating sustainability education into the formal education system, we can ensure that future generations are equipped with the knowledge and skills to address pressing environmental issues. This can empower students to become environmentally conscious citizens who actively participate in creating a more sustainable future. Moreover, incorporating environmental education into schools can also foster a sense of responsibility and stewardship towards the environment, encouraging students to make informed choices and take actions that contribute to the preservation of our planet.

#### *6.12. Implementing Stricter Regulations and Standards for Industries to Reduce Their Carbon Footprint and Promote Sustainable Production Processes*

The implementation of stricter rules and standards for Nigerian industries to reduce their carbon footprint and advance sustainable production techniques could have some novel policy implications, such as the introduction of a carbon pricing mechanism. This mechanism would involve putting a price on carbon emissions, either through a carbon tax or a cap-and-trade system. By creating a financial incentive for industries to reduce their emissions, this policy can encourage the adoption of cleaner technologies and practices, ultimately leading to a more sustainable industrial sector in Nigeria. Additionally, the government could consider providing subsidies to industries that invest in renewable energy sources or implement energy-efficient practices. These subsidies would help offset the initial costs of transitioning to cleaner technologies, making them more financially viable for businesses. By combining a carbon pricing mechanism with subsidies for clean energy, Nigeria can create a comprehensive policy framework that promotes sustainable production processes and drives the transition towards a low-carbon economy.

## 7. Conclusions

This paper investigates Nigeria's climate objectives and proposes strategies to accelerate progress and ensure credibility. It examines current policies and successful strategies from other countries and provides policy implications for Nigeria to enhance its climate action efforts. Potential scenarios include increasing renewable energy capacity, implementing stricter regulations and standards for industries, promoting sustainable production processes, and strengthening climate governance and policy frameworks. The authors found that implementing stricter regulations and standards would reduce carbon footprints, promote sustainable production, and strengthen climate governance. Factors such as preventing environmental degradation, funding environmentally friendly infrastructure, and improving public transportation systems can help Nigeria meet its climate goals more quickly. The authors developed policy measures based on twelve credible pathways to catch up with Nigeria's climate goals, promoting faster progress. Adopting these measures will significantly accelerate Nigeria's progress towards the proposed zero net by 2060, positioning it as a global leader in sustainable development and contributing to global efforts to mitigate climate change [21]. This will benefit the environment, lead to financial development, and improve citizens' living standards. Twelve policy measures proposed to facilitate Nigeria's achievement of climate goals in this study are found in Section 6. These twelve scenarios and policy measures encompass a comprehensive approach that addresses various aspects of sustainable development, including renewable energy adoption, efficient resource management, and climate resilience.

By achieving Nigeria's climate goals through its implementation, the nation can contribute significantly to global efforts in mitigating climate change and transitioning towards a low-carbon economy. Achieving zero emissions will not only reduce environmental impact but also improve air quality and public health for the Nigerian population. The adoption of renewable energy sources and efficient resource management practices can lead to job creation and economic growth, as it opens up opportunities for the development of new industries and technologies. This can help diversify Nigeria's economy and reduce its dependence on fossil fuels, ensuring a more sustainable and resilient future for the nation.

The shortcomings and limitations of this paper are as follows: 1. One limitation of the paper is the lack of comprehensive data on current emissions and energy consumption in Nigeria. Without accurate and up-to-date information, it becomes challenging to accurately assess the feasibility and effectiveness of proposed pathways for achieving climate goals. 2. Another shortcoming is the limited consideration of socio-economic factors that may impact the implementation of climate policies in Nigeria. Factors such as poverty, inequality, and political stability can significantly influence the success and acceptance of climate policies. Without taking these factors into account, there is a risk that the proposed strategies may not be suitable or sustainable in the Nigerian context. The lack of public awareness and engagement regarding climate change further hinders the implementation of effective policies, as it becomes difficult to garner support and participation from key stakeholders. 3. Its reliance on predictions and assumptions is one of the paper's drawbacks. As with any study that involves future predictions, there is inherent uncertainty in the accuracy of these assumptions, which may affect the credibility of the proposed pathways. 4. The proposed steps are not quantitatively assessed in order to meet a specific emissions target, such as Nigeria's net zero emissions by 2060, which would necessitate a more comprehensive and in-depth study.

The study also suggested that evaluating the effectiveness of renewable energy sources in catching up with energy demand in Nigeria could be a viable option for future research in the quest to achieve climate goals in Nigeria.

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