To What Extent Are the United States and Nigeria Able to Balance Economic Growth Against Emission Reduction Goals?

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ABSTRACT

The paper examines the link between economic growth and greenhouse gas emissions reduction, focusing on the United States and Nigeria. The study addresses the Nationally Determined Contribution (NDC) targets that ensure average surface temperatures do not exceed 1.5°C above preindustrial levels and are intended to achieve net-zero GHG emissions by 2050. It examines emission reduction strategies in five common sectors: electricity, transportation, industry, cooking, and building. The United States is ahead of Nigeria in achieving its emissions-reduction goals, but challenges persist in some sectors. The study suggests that economic prosperity can be achieved without relying solely on fossil fuels, but Nigeria has yet to establish a clear pathway to overcome these hurdles.

Keywords: greenhouse gas, net zero, United States, Nigeria

1. Introduction

Industrialized and developing countries have to balance economic growth against emissions-reduction goals to limit global warming to less than 1.5°C above the preindustrial level (Coopers, 2016, pp. 1-2). Developing countries face different trade-offs between economic growth and emissions reduction due to varying degrees of regional dependence on fossil fuels, differing economic structures, and distinct vulnerabilities to climate change (Ritchie, 2021). Industrialized countries have made significant progress in transitioning away from coal consumption and reducing carbon intensity (Alagidede et al., 2016). Developing countries are vulnerable when it comes to creating policies for growth and emission reductions that are affordable and achieve the set emissions-reduction targets.

This study aims to evaluate and examine the efforts of the United States (US) and Nigeria to reduce emissions by 2050 and 2060-2070, respectively, by conducting a comprehensive review of secondary data. It reveals that the US has devised a more effective strategy for reducing emissions than Nigeria. This research aims to shed light on the disparities and cooperation between industrialized and developing countries and reveal the crucial role of climate finance in supporting developing countries like Nigeria in achieving net zero objectives. This research aims to assess how well industrialized and developing countries can balance economic growth against emissions reduction goals, focusing on the US and Nigeria.

The US and Nigeria are economic partners with a focus on oil, mining, and investment in sectors like electricity, transport, manufacturing, technology, retail, and tourism (Tai 2022, p. 9). They have substantial trade ties, with the US exporting billions and Nigeria importing millions. However, the two countries have significantly different economic performance (USTR, 2024). CO_2 emissions data from 1960 to 2021 show a significant disparity between the two countries, with the US emissions four times those of Nigeria. Both countries have experienced a reduction in emissions, particularly following their commitments to the Paris Agreement.

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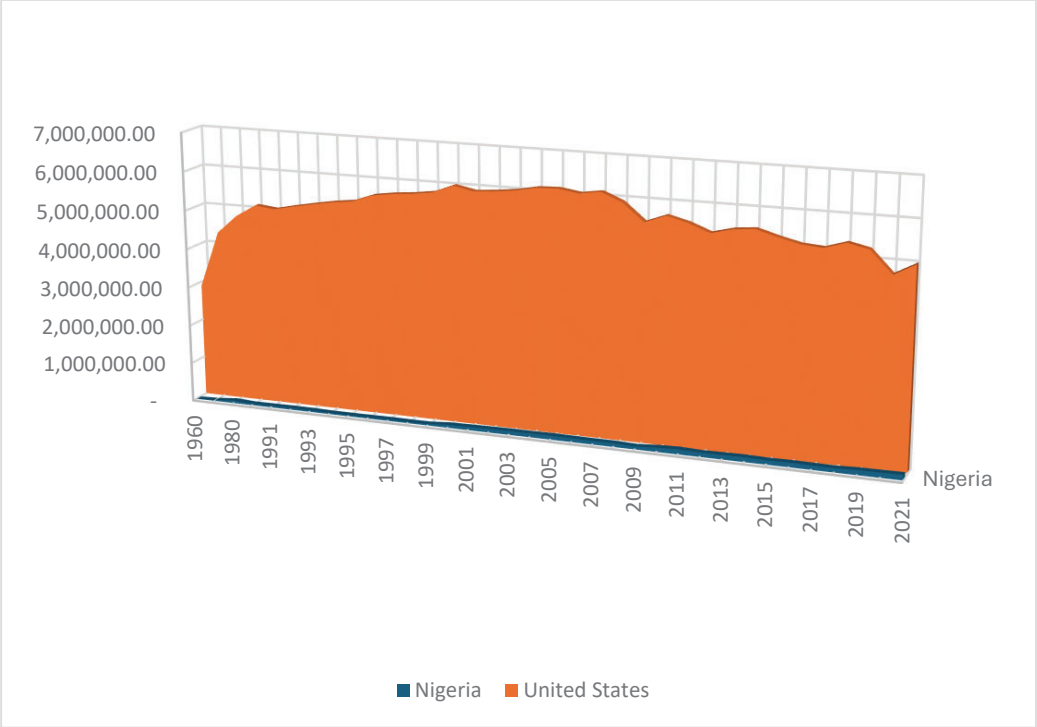
Data for this research was collected from various search engines using words such as “emission reduction”, “greenhouse gas sources”, “country targets”, and “GDP per capita”. The historical trajectory of emissions shows that emissions were relatively low before the Industrial Revolution, with gradual growth until the mid-20th Century. As seen in Fig.1, the US emitted 5.01 billion tons, peaking in the early 2000s, contributing to the global emissions burden. Nigeria emitted less due to unreliable and inadequate national grid electricity supply. Rapid sea level rise in Nigeria could cause erosion, flooding, and migration, among other consequences.

Fig. 1. Annual CO_2 emissions by country



Source: Our World in Data based on the Global Carbon Project (2023). OurWorldInData.org/co2-and-greenhouse-gas-emissions.

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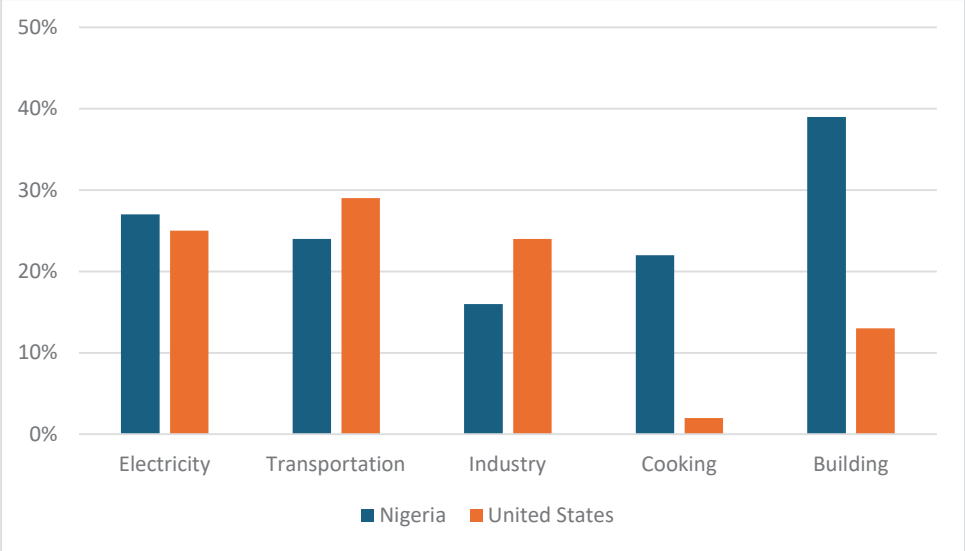
Fig. 2. Total Emissions by Sector



Sources: Nigeria energy transition plan. Energytransition.gov.ng/transport-2-2/; Center for Climate and Energy Solutions. www.c2es.org

2. Emission Pledge of the United States and Nigeria

The US aims to reduce emissions by 26% to 28% by 2025, while Nigeria aims to reduce emissions by 45% under specific conditions and achieve a 20% reduction below current levels by 2030. However, ambitious measures are proposed in the National Development Goals and revised National Policy on Climate Change (Dioha & Emodi, 2018, pp. 29-30).

2.1. Net zero sectors' strategies

The United Nations Framework Convention on Climate (UNFCCC) Conference of Parties introduced Low-Carbon Development Strategies to reduce GHG emissions. The US has committed to reducing GHG emissions to zero by 2050, including through actions in electricity, transportation, building, industry, and cooking for both short and long-term objectives (Horowitz et al., 2022; Whitehouse, 2021).

2.1.1. US net zero strategies

The US aims to achieve carbon-free electricity by 2035 by incorporating renewables and reducing coal-fired power generation. A 90% clean grid will be achieved by 2035 without new coal plants. From 2005 until 2019, the US marked a 32% decrease in CO_2

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generated (McGrath, 2021). New policies, incentives, and market reforms are essential to meet growing electricity demand (Phadke et al., 2020). Cost reductions in renewable energy generation, batteries, and storage technologies are expected to reduce emissions by 70-90% by 2030. Existing nuclear energy will remain in service, while solar and wind generation will continue to expand until 2050.

The US transportation sector is working to reduce emissions to have half new light-duty cars by 2030, produce 3 billion gallons of sustainable aviation fuel, and reduce costs across all modes of transportation by increasing fuel economy and emissions standards, providing incentives for zero-emission vehicles, expanding biorefineries, and investing in infrastructure to support all clean transportation modes.

The US building sector accounts for US electricity consumption, causing emissions from gas, oil, and other fuels. The goal is to achieve 100% clean power generation by 2035, eliminating emissions and facilitating efficient electrification of building appliances. Partnerships like the EPA's Energy Star program and building energy requirements will enhance efficiency.

The US has seen a significant reduction in space heating GHG emissions due to the widespread use of electric stoves, natural gas, and propane in household cooking appliances (Berrill et al. 2021, p. 6). Cooking accounts for a portion of the overall amount of electricity used by households in the US. 61% of household stoves use electricity, 31% using natural gas, and 5% using propane (Wright et al., 2020, p. 123).

Industries emit GHGs through energy consumption, onsite fossil fuel combustion, and non-CO_2 emissions. Achieving carbon-free electricity by 2035 will eliminate emissions and electrify low- and medium-temperature heat processes. Decarbonization strategies include energy efficiency, electrification, low-carbon fuels, feedstock management, and energy optimization (USDS, 2021, p.17).

2.1.2. Nigeria net zero strategies

Nigeria's Climate Change Act aims for net zero emissions by 2050, with the Renewable Energy Master Plan (REMP) aiming to increase renewable electricity's share from 13.5% in 2015 to 36% by 2030. By 2025, renewable energy will make up 10% of Nigeria's total energy consumption (IEA, 2013). Nigeria's emissions are primarily from electricity, transportation, oil and gas, cooking, and industry, accounting for 65% of the country's total emissions shown in Figure 2 (ETP, 2022, p.2).

Nigeria's energy strategy is the Nigeria electricity vision 30-30-30, which aims to generate 30 GW of electricity by 2030, with 30% coming from renewable sources. This will be done by replacing diesel and petrol generators with sustainable energy sources like solar and wind (Ibrahim et al., 2021, pp. 3-4).

The Nigeria Energy Transition Plan (ETP) places a strong emphasis on reducing transportation emissions, particularly from passenger vehicles, and promotes the use of

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low-emission technologies and mode-shifting with a focus on transitioning from gasoline/diesel and hybrid vehicles to electric buses and two- to three-wheelers.

The decarbonization strategy for cooking prioritizes the transition from traditional firewood, charcoal, and kerosene to Liquefied Petroleum Gas by 2030 and the promotion of efficient electricity usage and biogas, particularly in rural areas. Strategies for reducing emissions in the industrial sector include substituting clinker with calcined clay in cement production and reducing its demand by 20% by 2050, adopting bioenergy with carbon capture and storage and replacing grey hydrogen with green and blue hydrogen (Yetano Roche, 2023, p. 3).

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Table 1. Net Zero Action Plan

Sectors	United States	Nigeria
Electricity	Switch to clean fuels through efficient appliances, increase renewable energy use, and decrease coal-fired power through new policies, incentives, and market reforms by 2050.	Expand gas generation capacity by integrating renewable energy. By 2030, solar will be deployed through decentralized deployment in 2040, 2050, and 2060.
Transportation	Achieve dominance of zero-emission vehicle sales by 2030, and alternative modes.	Use low-emissions technology and mode-shifting, focusing on passenger vehicles by 2030.
Industry	Adopt low-carbon fuels and feedstocks to reduce emissions by 69-95% by 2050.	Replace clinker with calcined clay, using bioenergy.
Cooking	Enhance energy efficiency through increasing sales of clean and efficient electric appliances.	Transition to liquefied petroleum gas (LPG) from wood, charcoal, and kerosene by 2030.
Building	Achieve 100% clean power generation in public buildings, government facilities, schools, and universities by 2035 through investment.	Developers have three ways to ensure building compliance, along with the green star rating system (rated from 1 to 4). Renewable sources are expected to account for 50% of hot water usage in both residential and non-residential buildings.

The National Building Energy Efficiency Code (BEEC) requires all new buildings to adhere to the 1977 national building regulation for compliance (Lombe, 2017, p. 60). Since 2011, developers have been mandated to choose one of the three compliance route-prescriptive, performance, and reference route which are used for both residential and non-residential buildings. The prescriptive methods targets roof insulation, 50% of the hot water generated from non-electrical resistance heating, fenestration shading, and walls, while performance routes allow buildings to mimic performance and pass regulation using energy simulation to achieve projected energy savings. Nigeria has

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adopted the green star rating tool to minimize environmental impact and promote green building standards (Edeoja, & Edeoja, 2015, p. 120). This tool assesses a building adherence to BEEC initiative on a scale of 1-4 stars where higher ratings indicate efficiency in building operations (Lombe, 2017, p. 2).

3. Conclusion

The US and Nigeria share a common goal of reducing GHG emissions with strategies that complement each other. They both focus on different strategies. The US uses incentives to encourage cleaner energy adoption and Nigeria focuses on diversifying its energy sources through foreign support. The US and Nigeria's electricity sectors are closely interrelated, as seen in Table 1. The US building sector is actively pursuing a novel approach through extensive research to reduce emissions in the construction industry.

The US leverages its existing regulatory policies and offers various incentives to encourage cleaner energy adoption including financial incentives, tax credits, rebates, and policies related to net metering. This initiative encompasses and targets residential, commercial, government, institutional, and nonprofit entities. Furthermore, 30 states have actively mandated renewable energy requirements, while others have set voluntary goals for renewable energy (NSCL, 2021). And the Rural Energy for America Program (REAP) and low-income communities bonus credit programs provide renewable energy certificates, net metering, and feed-in tariffs to low-income households and rural areas (EIA, 2022). These programs are projected to increase employment opportunities by 2035, contributing to job creation, government revenue, and investment attraction (O'Boyle et al., 2021). These initiatives do not only aim to promote energy efficiency, but also to set up clean electricity guidelines, and attract investments in wind power, solar, and energy storage technologies. Conversely, there is room for improvement in the emissions reduction policy, particularly in the transportation sector, as this may pose a long-term concern while addressing the short-term goals.

Thus, the US transportation sector can examine battery decomposition that usually occurs with EV cars that potentially lead to increased battery combustion which is often associated with GHG emissions over the lifespan of a battery. Further investigation and research are crucial to determine the long-term effects on the economy and the environment. Additional obstacles faced in the transportation sector encompass upfront expenses associated with vehicle acquisition and inadequate charging infrastructure (Phadke et al, 2021). On the other hand, Nigeria's lack of a clear strategy for transitioning to cleaner energy sources is contributing to inequality, poor health, inadequate education, and poverty. Implementation remains uncertain across various ministries with various proposed plans.

Nigeria's emissions strategy aims to diversify energy sources, including hydropower (2111 MW), solar energy (19 MW), biofuels (10 MW), and wind (3 MW). The country's potential to generate more biogas from 227,500 tons of animal waste could improve

electricity supply (Olanipekun & Adelakun, 2020; Posibi, 2023; Kazimierczuk, 2019). The transportation sector is shifting toward electric vehicles and biofuel-based cars. It is expected that by 2030, 20% of private cars will be biofuel-based cars, and this percentage is expected to increase to 25% by 2050 for the market share for vehicles fueled by biofuel. This transition is expected to yield substantial benefits with a projected adoption rate of 10% for private cars and 35% for taxis by 2030 and 2050 respectively (IRENA, 2023, p. 13). The government encourages renewable energy investments through fiscal and market incentives under the REMP, aiming to create up to 840,000 net jobs by 2060.

Nigeria's electricity sector faces significant challenges, with its population of 213 million currently receiving about 7,200 megawatts of electricity, resulting in a significant gap between demand and supply (Monyei et al., 2018, p. 1583). Nigeria's transition to clean energy relies on foreign investors, donors, and climate funding, and the transportation sector is targeting the adoption of electric vehicles by 2050, which is expected to reduce CO_2 and boost GDP. However, attracting investors has been slow, and incentives and energy tax reductions have not attracted private and local investors. The reduction in emissions is expected to generate new job opportunities, while the oil and gas sector may experience job losses. A comprehensive database to track renewable energy investments and prioritize clean fuels from solar, wind, carbon-free hydrogen, and sustainable biofuels could enhance efficiency, which would be a significant step toward a sustainable future and Nigeria's goal to achieve net zero emissions by 2060.

Conflict of Interest

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