



NIGERIA ENERGY TRANSITION: THE ROLE OF GAS IN ACHIEVING A LOW-CARBON ECONOMY

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ABSTRACT

Nigeria's energy sector is undergoing significant transformation, driven by the need to reduce greenhouse gas emissions and transition to a low-carbon economy. Natural Gas plays a critical role in this transition, offering a cleaner-burning alternative to traditional fossil fuels. As the country strives to achieve a low-carbon economy, the role of Natural gas in this energy transition cannot be overstated. As a cleaner-burning fossil fuel, gas offers a compelling bridge between Nigeria's current reliance on oil and its aspirations for a low carbon economy. This article examines the potential of gas in Nigeria's energy mix, exploring its benefits, challenges and policy implications. It evaluates the critical role gas plays in Nigeria's energy transition, exploring its potential to: reduce greenhouse gas emissions, increase energy access, foster economic growth and diversify the energy mix. It discusses Nigeria's gas reserves, infrastructure and policy framework, highlighting opportunities for growth and development. Case studies illustrate successful gas utilization projects, such as the Nigeria Liquefied Natural Gas (NLNG) project and the Ajaokuta-Kaduna-Kano (AKK) gas pipeline project. Challenges and obstacles are also addressed, including: Infrastructure gaps, Regulatory hurdles, Security concerns, Competition from renewable energy sources etc. The article concludes that gas will play a vital role in Nigeria's energy transition, enabling the country to: meet growing energy demand, reduce carbon emissions, drive economic development by leveraging its gas resources; this way, Nigeria can create a more sustainable energy future, aligning with global efforts to mitigate climate change.

Keywords: Climate change mitigation, Natural Gas infrastructure, Gas utilization, Low-carbon economy, Nigeria energy transition, Renewable energy.

INTRODUCTION

As Nigeria seeks to transition towards a low-carbon economy, natural gas emerges as a pivotal component of its energy strategy. The country's abundant gas reserves position it uniquely to leverage this resource, particularly in light of global commitments to reduce carbon emissions and mitigate climate change. The Nigeria Liquefied Natural Gas (NLNG) and the Ajaokuta-Kaduna-Kano (AKK) gas pipeline projects serve as a compelling case study, illustrating how gas can facilitate this transition while promoting economic growth. Natural gas is often viewed as a cleaner alternative to coal and oil, producing lower carbon emissions when combusted. In Nigeria, where energy demand is rising due to population growth and industrialization, the potential of gas to support a more sustainable energy landscape is significant. The country holds the ninth-largest gas reserves globally, and topmost in Africa estimated at over 200 trillion cubic feet (Fig. 1: International Energy Agency, 2022, International Gas Union, 2022).

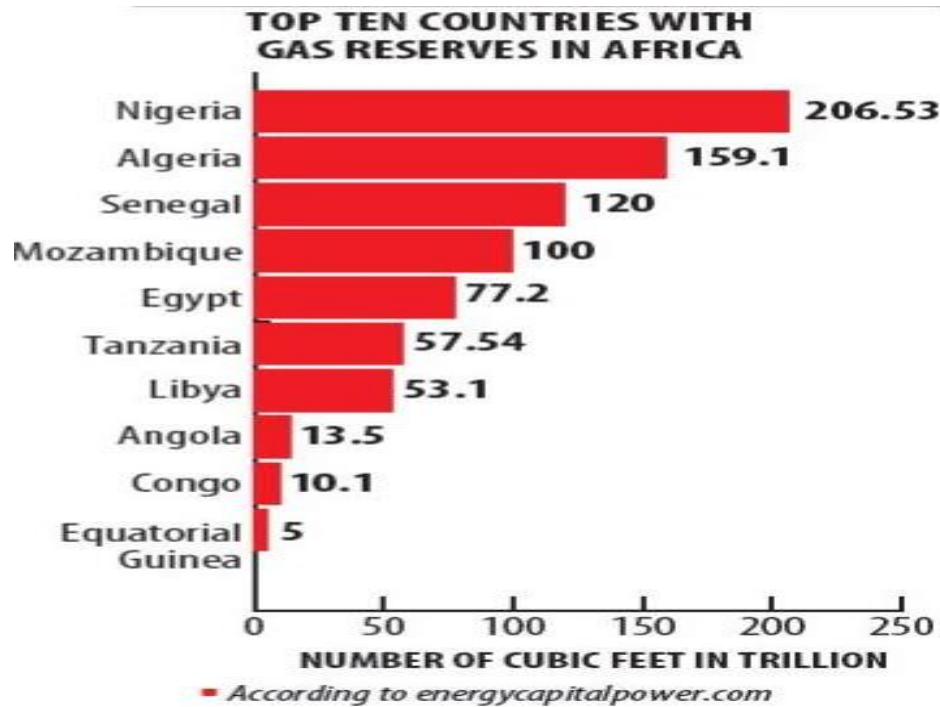


Fig. 1: Top ten countries with gas reserves in African (energycapitalpower.com)

Nigeria’s energy sector is dominated by fossil fuels, contributing to climate change and environmental degradation. By prioritizing natural gas in its energy mix, Nigeria can reduce its reliance on more carbon-intensive fossil fuels (Fig. 2), thus supporting the global transition to cleaner energy sources. As the nation grapples with increasing energy demand, gas can facilitate a shift from more polluting energy sources, significantly reducing greenhouse gas emissions.

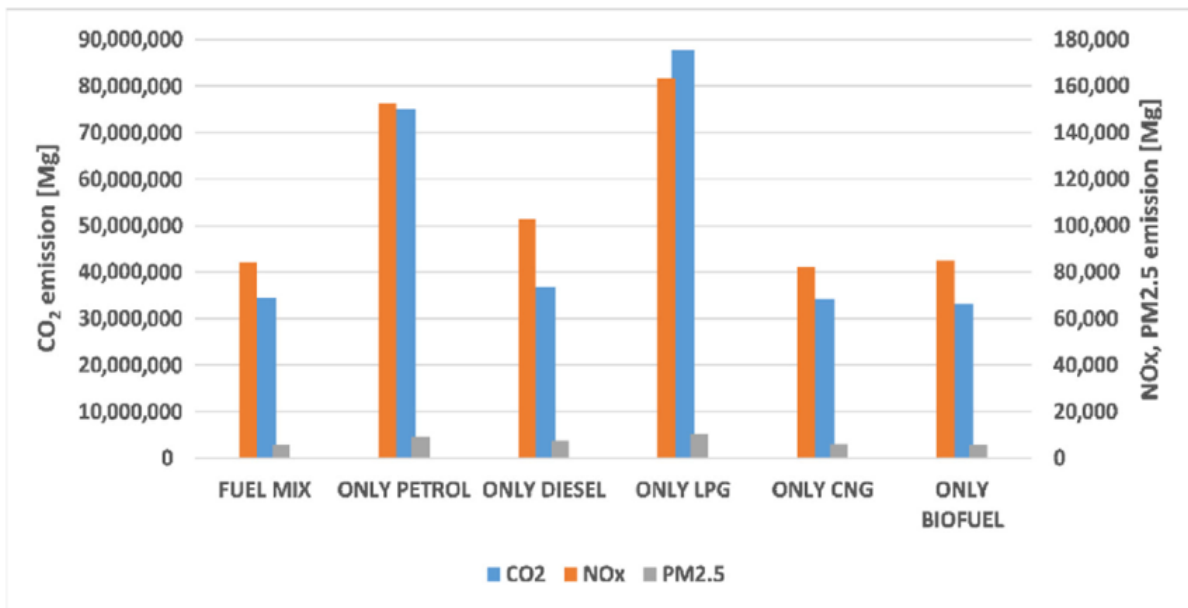


Fig. 2: Comparison-of-CO2-NOx-and-PM25-emissions-depending-on-fuel-type

METHODOLOGY

These Projects are testaments that the country is transiting from petrol, coal, diesel to natural Gas (then to renewable energy sources as shown in Fig. 3)

Case 1: The NLNG Project: A Model for Sustainable Energy

The NLNG project, established in 1989, is a joint venture between the Nigerian government and several international oil companies. Its primary objective is to process Nigeria’s natural gas for export, thus generating revenue and reducing flaring—a practice that contributes significantly to greenhouse gas emissions. The project has played a crucial role in positioning Nigeria as a significant player in the global LNG market, with exports reaching over 22 million metric tonnes per year as of 2023 (Nigeria LNG Limited, 2023).

As the world moves towards more stringent climate goals, Nigeria's strategy of leveraging natural gas through projects like NLNG is crucial. It allows the country to meet immediate energy demands while aligning with global low-carbon aspirations. By fostering a conducive environment for investment in gas infrastructure and renewable energy, Nigeria can pave the way for a sustainable energy future. The NLNG project exemplifies how gas can be utilized to support economic and environmental goals. By converting natural gas into LNG, the project not only mitigates emissions but also creates jobs, stimulates local economies, and enhances Nigeria’s energy security. Moreover, the revenue generated from LNG exports can be reinvested into renewable energy projects, further diversifying Nigeria's energy portfolio.

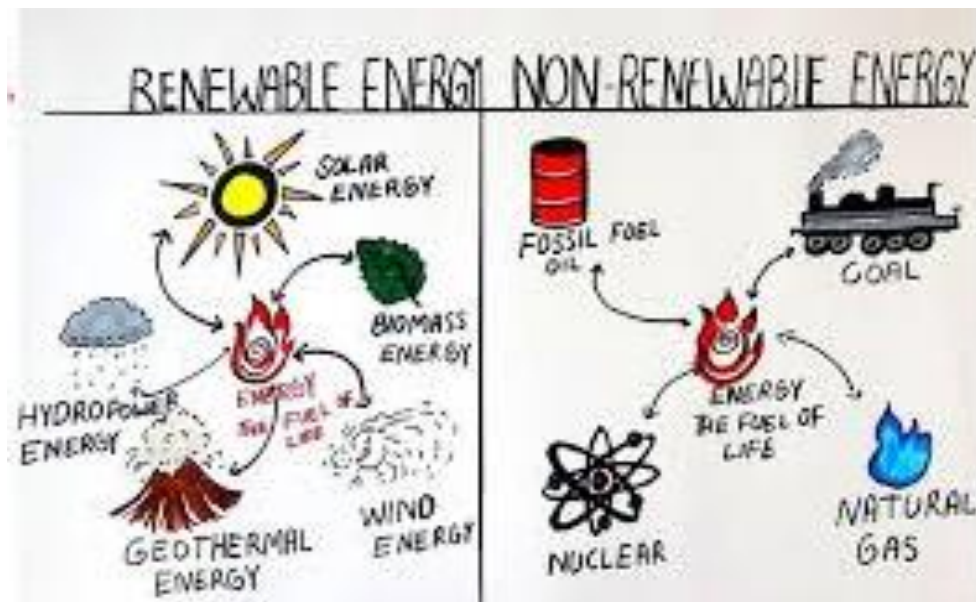


Fig. 3: Renewable and Non-Renewable Energy

Case 2: The AKK Project: Enhancing Gas Infrastructure

The Ajaokuta-Kaduna-Kano (AKK) gas pipeline project which began in 2020 and expected to be completed in 2025 is another significant case study, illustrating how natural gas can support economic growth, low carbon economy, energy security and environmental sustainability. The AKK project is a landmark initiative designed to enhance Nigeria's gas infrastructure. Spanning approximately 614 kilometers, the pipeline aims to transport natural gas from the southern (Ajaokuta) gas-producing regions to the northern (Kaduna-Zaria-Kano) parts of the country

(Nigerian National Petroleum Corporation [NNPC], 2020). By improving access to gas, the AKK project is expected to stimulate industrial growth, enhance power generation and reduce the reliance on more carbon-intensive fuels.

The project is expected to deliver around 2.2 billion cubic feet of gas per day, providing a significant boost to Nigeria's energy supply. By integrating natural gas into the national grid, the AKK pipeline can help increase electricity generation, which is essential for industrialization and economic development (Oluwaseun, 2021). This enhanced energy access is vital for achieving Nigeria's long-term economic goals. Utilizing natural gas through initiatives like the AKK project can lead to substantial environmental benefits. This is because natural gas is cleaner-burning than oil and coal, making it a suitable transitional fuel that can significantly reduce carbon emissions from the various users in the sector (Figure 4). However, challenges remain in fully realizing the potential of gas. These include the need for robust regulatory frameworks, infrastructure development and investment to ensure the reliable supply of gas (Federal Ministry of Petroleum Resources, 2021).

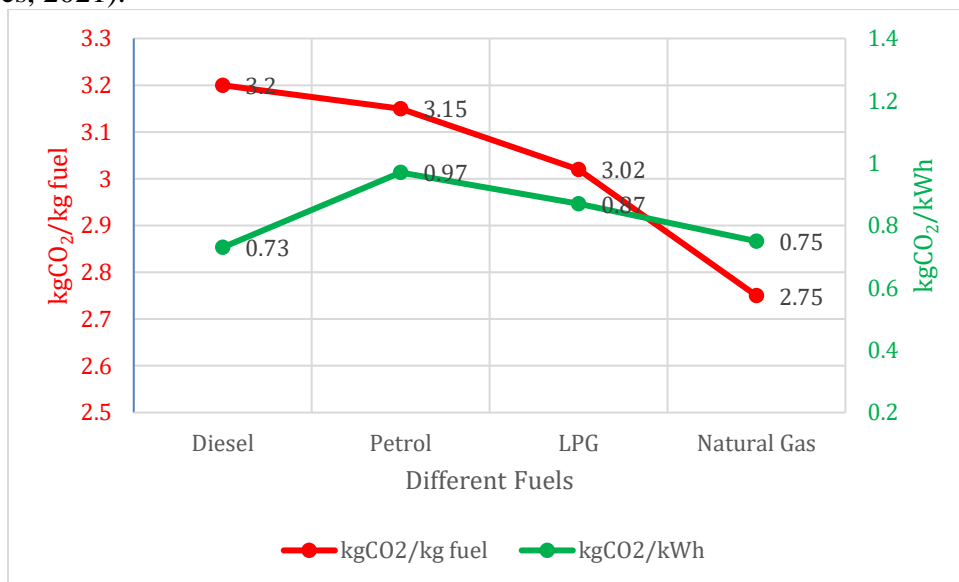


Fig. 4: Comparison of CO₂ emission for different fuels

The Nigerian government has recognized these challenges and is working to create a more conducive environment for gas utilization. Policies aimed at enhancing investment in gas infrastructure and reducing flaring are critical for maximizing the environmental benefits of natural gas.

RESULTS AND DISCUSSION

Navigating the Challenges through these projects' lifecycle:

Nigeria is at a pivotal juncture in its energy transition, aiming to reduce its dependence on fossil fuels while enhancing energy access and promoting economic growth. This discussion explores the results of various initiatives aimed at achieving a sustainable energy future, particularly the role of natural gas, as well as the challenges that remain. Despite its advantages, the utilization of natural gas in Nigeria faces several challenges. Infrastructure deficits, regulatory hurdles, market inefficiencies, security challenges etc hinder the effective harnessing of gas resources. The government must address these issues to unlock the full potential of gas in achieving a low-carbon economy. Review and implementation of the Initiatives such as the National Gas Policy and the

Nigerian Gas Master Plan strategic themes (Figure 5) aim to streamline gas production and distribution, enhancing accessibility and reliability (Federal Ministry of Petroleum Resources, 2021) should be followed up.

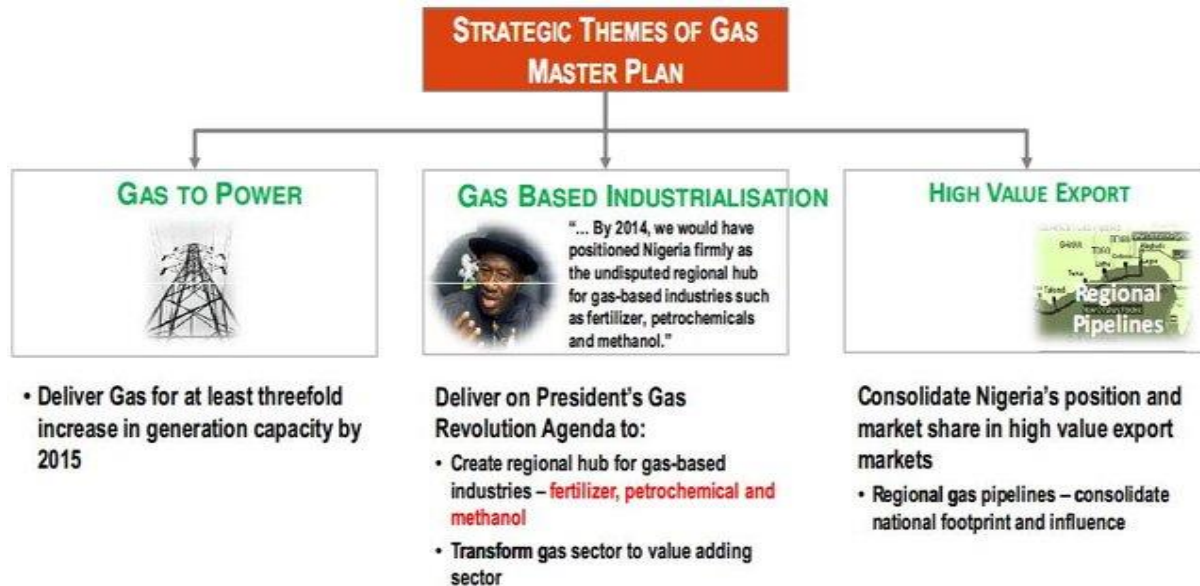


Fig. 5: Themes of the gas master plan

Security Concerns

Security issues complicate Nigeria's energy transition. The country faces significant challenges related to insurgency, vandalism and theft, particularly in the oil and gas sectors. These threats not only endanger infrastructure but also deter foreign investment, which is critical for funding renewable energy initiatives. For instance, attacks on pipelines and energy facilities have led to substantial revenue losses and increased operational costs for energy companies (International Crisis Group, 2022). Enhancing security measures and fostering partnerships between the government, private sector and local communities are vital steps in mitigating these risks

Regulatory Hurdles

Regulatory challenges impede progress in Nigeria's energy transition. The lack of a coherent policy framework and inconsistent regulations create uncertainty for investors and project developers. While the Nigerian government has made strides through policies like the Renewable Energy Master Plan (REMP), the implementation remains uneven (Federal Ministry of Power, 2020). The energy transition in Nigeria necessitates a balanced approach that incorporates both fossil fuels and renewable energy sources. While natural gas will play a vital role in the interim, the ultimate goal should be to develop a diverse and sustainable energy mix. The Nigerian government has set targets for renewable energy deployment, including solar and wind, which can complement gas in reducing carbon emissions. Streamlining regulations and ensuring a stable policy environment are crucial for attracting investment and facilitating the development of renewable energy projects. Clear guidelines regarding incentives, grid access and tariffs are necessary to build investor confidence. (Federal Ministry of Petroleum Resources, 2021).

Gas Pricing

One significant issue is the misalignment between domestic pricing structures and global market trends. While international markets demand competitive prices, the Nigerian government regulates domestic prices, often setting them lower than global benchmarks. This discrepancy discourages investments in gas infrastructure and exploration, as investors prioritize markets offering higher returns (Aigbedion & Iyayi, 2020). The uncertainty surrounding gas pricing policies creates market instability, affecting long-term contracts and investment decisions (Ogbeifun & Ezenwafor, 2021). Additionally, gas producers contend with operational inefficiencies, poor pipeline networks, gas flaring etc, which further escalate production costs, ultimately influencing pricing strategies (Adewuyi & Ademola, 2019). Again, the issue of subsidy management in Nigeria’s energy sector complicates pricing, as subsidized rates hinder cost-reflective pricing models. These challenges necessitate reforms aimed at balancing government control with market-driven pricing mechanisms, fostering investment and promoting sustainable energy development.

Competition Within the Energy Sector

The competitive landscape of Nigeria's energy sector presents another layer of complexity. Traditional energy sources, particularly oil and gas, dominate the market, making it challenging for renewable energy to gain a foothold. The entrenched interests of fossil fuel industries often lead to resistance against policies promoting the transition to renewables (Olaoye et al., 2021). The competition for investment and resources can result in a fragmented approach to energy development, where initiatives may not align with national goals (probably because of the investment in the oil sector due to the huge reserves as seen in Fig. 6). Creating a balanced energy policy that supports both traditional and renewable energy sources is essential for a successful transition.

Major oil producing countries in Africa - millions of barrels of oil per day

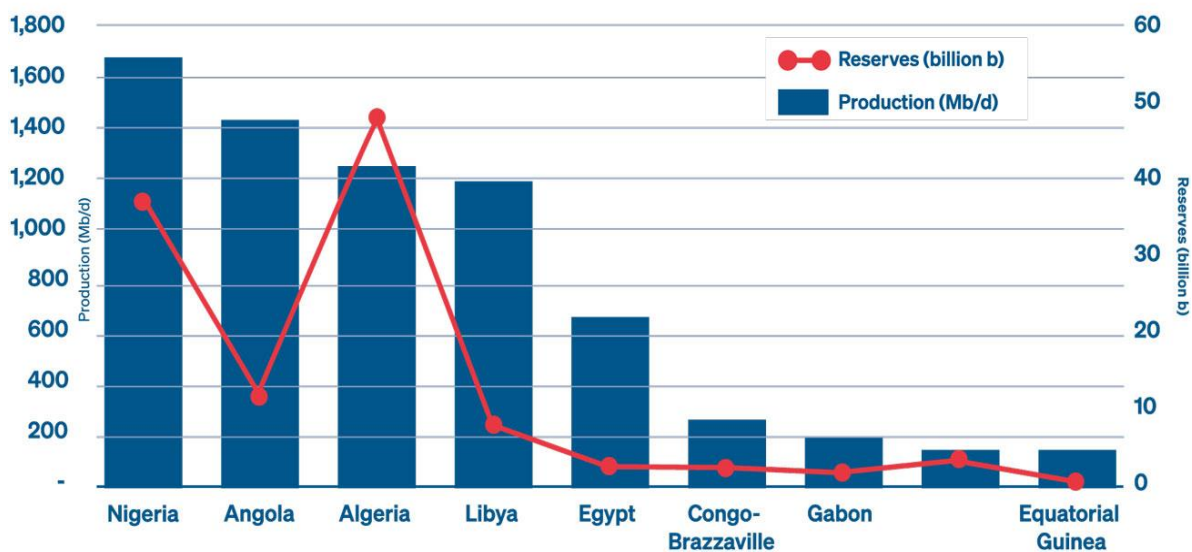


Fig. 6: Major oil producing countries in Africa

Aging and insufficient infrastructure

One of the primary obstacles to Nigeria's energy transition is its aging and insufficient infrastructure. The country's electricity grid suffers from frequent outages and limited capacity, hampering efforts to increase renewable energy integration (World Bank, 2021). Investments in modernizing and expanding transmission and distribution networks are essential to support new energy projects, particularly in renewable sectors such as solar and wind. Without robust infrastructure, the ability to generate and distribute clean energy effectively remains severely limited.

The Path Forward

To overcome these challenges, Nigeria must adopt a comprehensive and integrated approach. This includes investing in infrastructure, developing a stable regulatory framework, enhancing security measures and fostering collaboration among various energy sectors. Engaging local communities in renewable energy projects can also help to address security concerns and ensure the equitable distribution of energy resources.

Furthermore, international partnerships and financing can play a pivotal role in supporting Nigeria's energy transition. By leveraging foreign expertise and investment, Nigeria can accelerate the development of its targeted renewable energy sector and build a more resilient energy system.

The Future of Nigeria's Energy Transition

The successful implementation of the AKK project can catalyze Nigeria's transition towards a more sustainable energy landscape. By integrating natural gas with renewable energy sources, Nigeria can develop a diversified energy portfolio that addresses immediate energy needs while laying the groundwork for a sustainable future. In this context, natural gas serves as a bridge, facilitating the transition while enabling Nigeria to meet its climate goals. The potential for using gas to drive economic growth and reduce carbon emissions is significant, and the NLNG/AKK project exemplifies this dual benefit.

Reducing Greenhouse Gas Emissions

One of the foremost benefits of Nigeria's energy transition is the potential to reduce greenhouse gas emissions. The country's heavy reliance on fossil fuels, particularly petrol and diesel, has contributed to high emission levels. Transitioning to natural gas and ultimately to renewable energy sources such as solar, wind, and hydroelectric power can significantly lower these emissions. According to the International Renewable Energy Agency (2021), embracing renewables can reduce Nigeria's carbon footprint while contributing to global climate goals. By prioritizing clean energy, Nigeria can position itself as a leader in the fight against climate change.

Fostering Economic Growth

Increased energy access not only improves quality of life but also enhances productivity, especially in rural areas where economic activities are often hampered by energy shortages. The energy transition can act as a catalyst for economic growth. Investing in natural gas infrastructure creates jobs in manufacturing, installation, and maintenance. A study by the International Labour Organization (2020) estimates that transitioning to gas and ultimately renewable energy could generate over 1 million jobs in Nigeria by 2030. Moreover, the growth of gas/ renewable energy

sector can stimulate local economies by supporting ancillary industries and encouraging entrepreneurship in clean energy technologies.

Diversifying the Energy Mix

Diversifying Nigeria's energy mix is crucial for energy security and resilience. While the country has abundant oil and gas resources, dependence on these fossil fuels exposes it to global market fluctuations. By incorporating renewable energy sources into the energy transition portfolio, Nigeria can reduce its vulnerability to price volatility and enhance energy security. This diversification also aligns with global trends towards sustainable energy systems, positioning Nigeria favorably in international markets.

Improving Infrastructure

Nigeria's existing energy facilities/infrastructure requires significant upgrades to support the transition to natural gas. Investments in energy storage and transmission systems are essential to accommodate the variability of natural gas sources. A robust infrastructure not only enhances energy reliability but also fosters technological innovation. According to the Nigerian Electricity Regulatory Commission (2022), modernizing infrastructure can improve efficiency and reduce losses in energy distribution.

Exploring Gas Reserves

The country possesses vast gas reserves (Figure 1) that can be harnessed to provide cleaner energy during the transition phase. Natural gas plays a pivotal role in Nigeria's energy transition. By developing gas infrastructure and promoting its use for power generation and industrial applications, Nigeria can reduce reliance on more polluting fossil fuels. The Nigeria Liquefied Natural Gas (NLNG) project exemplifies how gas can be utilized to drive economic growth while supporting environmental goals (Nigeria LNG Limited, 2023).

Better Policy Framework

Finally, establishing a coherent policy framework is vital for facilitating Nigeria's energy transition. Effective policies e.g. tax rebate should promote investment in gas facilities and management, renewable energy, security architecture, gas pricing, streamline regulations and incentivize innovation. The Nigerian government has made progress through initiatives like the Renewable Energy Master Plan, but more comprehensive and consistent policies are needed to attract private investment and ensure a stable energy market.

CONCLUSION

Nigeria's energy transition is fraught with challenges related to infrastructure, regulation, security, market price and competition. Addressing these issues will require concerted efforts from the government, private sector and civil society. Nigeria's energy transition hinges on the strategic utilization of natural gas, as exemplified by the NLNG/AKK projects. By embracing gas as a transitional fuel, Nigeria can significantly reduce its carbon footprint while fostering economic development. The successful implementation of policies and infrastructure improvements will be essential in navigating the challenges ahead, ensuring that Nigeria remains a key player in the global energy landscape. We see that by leveraging gas as a transitional fuel, Nigeria can address energy demands while advancing towards a low-carbon economy. The successful realization of this project, alongside effective policy implementation, will be crucial in ensuring that Nigeria

remains a key player in the global energy landscape. Creating a conducive environment for renewable energy development and ensuring a balanced energy strategy will ensure Nigeria can move towards a sustainable energy future that meets the needs of its population while reducing its carbon footprint.

The energy transition presents a unique opportunity to reduce greenhouse gas emissions, increase energy access, foster economic growth, diversify the energy mix, improve infrastructure, explore gas reserves and implement better policy frameworks. This transition is particularly vital given the increasing domestic energy demand driven by population growth and industrial expansion. The adoption of natural gas can lead to cleaner power generation, which is essential for both environmental sustainability and economic development (Oluwaseun, 2021)

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