

Development of Sustainable Energy Transition Options for Rapid Industrialization in Nigeria

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Abstract:- Nigeria, as a pivotal economic force in Africa, stands on the brink of rapid industrialization. This pursuit holds immense promise, but it is fraught with challenges, not least of which is the need for a sustainable energy transition. This research paper embarks on a comprehensive exploration of the imperative to develop sustainable energy transition options that align with Nigeria's unique socioeconomic and environmental context. It scrutinizes the current energy landscape, identifies industrial priorities, assesses renewable energy potential, and delves into policy, financial, and infrastructural considerations essential for forging a sustainable energy ecosystem. Furthermore, this paper underscores the significance of community engagement, international collaboration, and adaptability as pivotal components of Nigeria's journey toward sustainable industrialization through energy transition.

Keywords:- Nigeria, Rapid Industrialization, Energy Transition, Sustainable Energy Transition Options.

I. INTRODUCTION

Energy plays the most vital role in economic growth, progress, and development, as well as poverty eradication and security of any nation. Uninterrupted energy supply is a vital issue for all countries today. Future economic growth crucially depends on the long-term availability of energy from sources that are affordable, accessible, and environmentally friendly. Security, climate change, and public health are closely interrelated with energy. Energy is an important factor in all the sectors of any country's economy. The standard of living of a given country can be directly related to the per capita energy consumption. The recent world energy crisis is due to two reasons: the rapid population growth and the increase in the living standard of whole societies. The per capita energy consumption is a measure of the per capita income as well as a measure of the prosperity of a nation. Energy supports the provision of basic needs such as cooked food, a comfortable living temperature, lighting, the use of appliances, piped water or sewerage, essential health care (refrigerated vaccines, emergency, and intensive care), educational aids, communication (radio, television, electronic mail, the World Wide Web), and transport. Energy also fuels productive activities including agriculture, commerce, manufacturing,

industry, and mining. Conversely, a lack of access to energy contributes to poverty and deprivation and can contribute to economic decline (Adekoya, L. & Adewale, A.A.1992). Energy and poverty reduction are not only closely connected, but also with socioeconomic development, which involves productivity, income growth, education, and health (Oyedepo Energy, Sustainability and Society 2012)

Nigeria, as the most populous nation in Africa and boasting vast natural resources, stands on the precipice of an unprecedented era of growth and development through rapid industrialization. This pivotal juncture, however, is marked by the imperative of not just pursuing industrialization but doing so in a manner that is sustainable, both economically and environmentally. At the heart of this sustainable transformation lies the critical need for a well-structured and forward-thinking approach to energy transition.

The term "energy transition" embodies a profound shift from conventional, often fossil-fuel-driven, energy sources to cleaner, more sustainable alternatives. For Nigeria, a country traditionally dependent on the extraction and export of oil and gas, this transition is not merely an option; it is an imperative driven by economic diversification, environmental preservation, and global commitments to combat climate change.

Therefore, this paper embarks on a journey to explore, analyze, and elucidate the multifaceted process of developing sustainable energy transition options that are not only aligned with Nigeria's unique challenges but also harness its abundant opportunities. These options are envisioned to catalyze and sustain rapid industrialization, which is a pivotal driver of economic prosperity, job creation, and improved living standards.

II. METHODOLOGY

This study employs an exploratory research approach through engaging extant literatures in the field of sustainable development of energy transition options towards rapid industrialization in Nigeria. Content analysis of library materials, journal publications, internet materials and textbook relevant to the subject matter were utilized for the study.

Thus, the paper relied on the secondary sources of data collection. Secondary data are usually historical and already collected data that does not necessitate access to respondents or subjects (Ember & Levinson, 1991). The major advantage of this source of data collection is in the fact that it is less expensive than the primary source of data collection as it has already been collected (Zikmund, 1984).

III. AREA OF DEVELOPMENTS

➤ *Ongoing Initiatives*

Government Clean Cooking Stoves One of the major programs inaugurated by the Nigerian government as part of its commitment to improve energy access in Nigeria and reduce reliance on wood and kerosene for cooking is the “Clean Cooking Stove” program. The program is being developed and run by the Nigerian Alliance for Clean Cookstoves. Key Highlights; Over 160,000 Stoves (smokeless and ethanol stoves) sold and 800,000 litres of ethanol cooking fuel produced and sold; \$ 10million beneficiaries targeted for the next phase over 5years. Source: Clean Cooking Alliance.

➤ *Nigeria Gas Expansion Program*

As part of the Economic Sustainability Plan (ESC) developed in response to the covid pandemic, the government launched the National Gas Expansion program committing over N90billion to CNG development in track 1 and N25billion to provide LPG clean cooking fuel to 30million homes. The plan was put into place in March 2020. Prior to the ESC, the Ministry of Petroleum Resources, working through the Central Bank Of Nigeria has availed N250billion out of the Power and Aviation Fund (PAIF) to provide low-cost financing for oil and gas companies seeking to develop CNG or LPG retail infrastructure. As at the time of this report no LPG or CNG projects have taken off yet under these programs. If the program succeeds approximately 5million tons of clean cooking gas will be developed and about 20-25million cubic meters of CNG will be consumed per day thereby having significant impact on emissions by the transport sector.

➤ *REA Solar Program*

Nigeria established the Rural Electrification Agency (REA) to execute its solar electrification plan with funding support from the World Bank. REA’s mandate involved “fast and costeffective expansion of electricity access in un-electrified rural areas evenly across the different geopolitical zones in Nigeria” through both off-grid and on-grid electrification solutions. The REA program is supported by the World Bank with a \$350million facility out of which \$150m is dedicated to mini grids. Focus will be on solar mini grids (less than 1MW) and solar home systems targeted at 200,000 households and 50,000 SME. All of which shall be implemented under a market-based approach. Achievements so far by: * Nigeria Energy Transition 272,492 SHS installed 9,580kW Energy deployed by SHS 5037 Mini-grid Connections 855kW Energy installed through mini-grids 5m SHS and Mini grids targeted by 2023 under the Energy for all Project. 23 Hidden in plain sight:

Nigeria’s Energy Transition Nigeria Gas Policy In tandem with its climate commitments and as part of the 7 big wins.

➤ *Power Sector*

The transformation of Nigeria’s electricity supply system is plagued with several challenges, some of which are common to both the centralised and decentralised systems. The main challenges facing the entire power sector include inadequate financing, relatively high investment risks and policy uncertainty (Latham & Watkins, 2016). The setbacks facing the centralised system are insufficient generation capacity, weak transmission and distribution infrastructures, gas supply constraints, seasonality of water levels, and governance (Latham & Watkins, 2016; Wijeratne et al., 2016). Recent policy developments such as those that were intended to meet the goals of the National Policy on Renewable Energy and Energy Efficiency aimed to address aforementioned challenges include the feed-in tariffs for renewable energy, new metering regulations and guidelines allowing large consumers to purchase power directly Nigeria has a huge potential off-grid market whether based on solar photovoltaic (PV) mini-grids or through solar home systems. Currently, based on life-cycle assessment, stand-alone solar PV systems are already cost-competitive compared with conventional diesel and gasoline generators used in the country as back-up (Esan et al., 2019). However, solar PV systems have higher initial capital outlay, which makes them unattractive for the poor consumers. Some of the key barriers for investments in the Nigerian decentralised renewables space include poor consumer affordability and poor enabling environment (Latham & Watkins, 2016). Recent policies and programmes, such as the 2016 mini-grid regulation introduced by the Nigerian Electricity Regulatory Commission and government removal of import duties on some solar components, aim to ameliorate the aforementioned challenges (NERC, 2016; Department for International Development, 2019). from generating companies.

While the Nigerian power sector continues to struggle, poor financing remains the key bottleneck to lack of progress. The Nigerian power sector will require substantially more investment to achieve constant power supply. In terms of improving electricity access, around USD 34.5 billion in total investment will be required to provide electricity access to all households by 2030 (Ohiare, 2015). The Transmission Company of Nigeria (TCN) suggests that rehabilitation and expansion of the grid will require an annual investment of USD 1 billion for the next ten years (TCN and PMU, 2017). Currently, the World Bank is financing a USD 486 million International Development Association credit for the Nigerian Electricity Transmission Access Project, to support the development of Nigeria’s transmission system (World Bank, 2018). The African Development Bank, which is already working with the country on a USD 410 million transmission project, has pledged to invest an additional USD 200 million through the Rural Electrification Agency, in order to expand electricity access in the country (AfDB, 2020). Recently, the Nigerian federal government signed a six-year deal with Germany’s Siemens AG for a three-phase electrification project aimed

at increasing Nigeria's power to 25 000 megawatts (MW) that amounts to NGN 1.15 trillion (around USD 3.8 billion [2020]) (U.S. Department of Trade, 2021).

➤ *Agriculture*

Although relatively small in energy terms, the agricultural sector plays an important role in the Nigerian economy as it provides livelihood for around 70% of rural dwellers. Primary agriculture accounts for just around 1% of total final energy demand. The energy demand of the Nigerian agriculture sector has remains relatively stable over the years at around 4 kilotons of oil equivalent (IEA, 2021). The fuel mix of the Nigerian agriculture sector mainly consists of diesel, gasoline and kerosene.

Diesel is the most important energy source in the agricultural sector and accounts for more than half of the energy consumed, and it is primarily used to power irrigation pumps and fuel vehicles, such as tractors and combine harvesters. Diesel is used to run diesel irrigation pumps. A small amount of electricity is used to power grid-based irrigation pumps. Renewable energy technology application is still at a nascent stage of deployment in the sector with just a few solar water irrigation pumps installed in the country. In terms of technological options, Nigeria's agriculture is still underdeveloped and mainly depends on manual labour. With the anticipated future mechanization, growth in population and corresponding food demand, energy consumption of the sector is expected to increase substantially. While the federal government of Nigeria has developed several policies for the country's agriculture sector, such as the Agricultural Promotion Policy, many energy-related developments in the sector have been at state levels. For instance, in 2018, the Sokoto state government awarded a contract for the construction of 250 solar-powered water schemes, which will be developed in rural areas across the state's 23 local government areas (Solar Business Hub, 2018). However, the impact of some of these schemes remains to be seen.

➤ *Transport*

Nigeria is also not exempt from the negative impacts of fossil fuel-driven transport. Many Nigerians, in particular those living in traffic-congested towns and cities, such as Lagos and Port Harcourt, are exposed to air pollution, which contributes to cardiovascular and respiratory diseases, and this exacerbates poverty in the country. In recent years, the federal government of Nigeria has shown its commitment to implement policies and strategies to advance a safe, secure, affordable and sustainable transport system in the country. The Nigerian Biofuel Policy and Incentives came into effect on 24 July 2007 (IEA and IRENA, 2021). The aim is to gradually reduce the nation's dependence on imported gasoline and reduce environmental pollution while at the same time creating a commercially viable industry that can generate sustainable domestic jobs. The NREAP further outlines the intention of the federal government of Nigeria to incorporate biofuels into the transport fuel mix. Currently, there is a ban on the import of two-stroke motorcycles, and the use of motorcycles for commercial purposes has also been banned in certain parts of major cities such as Abuja

and Lagos. There are also regulations guiding vehicle emissions standards for all new and imported vehicles (Opara, 2011; George, 2020). The launch of the National Automotive Industry Development Plan in 2014 attracted the interest of leading international carmakers and led to the resumption of small-scale vehicle assembly in the country. According to the National Automotive Design and Development Council (NADDCC), there are 31 licensed producers of cars, trucks and buses currently operating in Nigeria with a combined installed capacity of 205 000 vehicles a year, though far fewer numbers are produced due to huge funding, infrastructure and capacity gaps. In early 2019, the NADDCC stated that only nine of the assemblers were active. Consequently, in March 2020, as a mark of relative success, the government commissioned USD 1 billion worth of locally assembled vehicles which were made by 17 companies (U.S. Department of Trade, 2021). In all, it appears the high import tariff regime aimed at discouraging imports and spurring local assembly has not yet achieved its goal. After several attempts to reform Nigeria's downstream oil sector, the Buhari administration has taken steps to reduce fossil fuel subsidies and move to a market-based pricing regime for gasoline in the wake of the oil price crash (Gupte, 2020). The subsidy removal may impact the fuel mix of Nigeria's transport sector. The proportion of private vehicles that run on diesel is negligible, with commercial vehicle owners also opting to run petrol vehicles wherever possible. Hence, it is expected that if alternative vehicle fuels become cheaper than gasoline, many car owners may consider a switch to the less expensive fuel. To make this scenario possible, on 1 December 2020, the Nigerian government launched its National Gas Expansion Programme aimed at distributing LPG across gas stations in order to promote the wider use of gas in vehicles (Reed, 2020).

➤ *Buildings Sector (Residential and Commercial)*

Nigerian households and commercial enterprises (restaurants, malls, banks, hotels, etc.) use energy for different purposes: cooking, water heating, lighting, air conditioning, refrigeration and for powering other miscellaneous electrical appliances such as fans, computers, washing machines, phones, televisions (TVs) etc. Owing to the increases in GDP, per capita income and urbanization, improved lifestyle, and the general increase in population, there has been a substantial increase in Nigeria's residential sector energy demand.

Various programmes have been initiated to reform the residential and commercial sectors in Nigeria as a solution to the challenges. Recently, there have been a lot of efforts and political discussions to provide all households in Nigeria with modern energy access by 2030. The National Renewable Action Plan (NREAP) and the Sustainable Energy for All (SEforALL) Action Agenda⁵ seek to increase electricity access to around 75% (90% in urban areas and 60% in rural) by 2020 and to 90% by 2030.

➤ *Waste*

Nigeria is richly endowed with bioenergy resource potentials of many varieties that are yet to be fully

harnessed. Biodegradable agricultural and municipal solid wastes hold great potential for meeting the growing energy needs of the country while having the dual benefit of reducing pollution by producing biogas using anaerobic digestion.

Nigeria has substantial volumes of waste that can be anaerobically digested to produce biogas that can be upgraded to biomethane for cleaner combustion.

This resultant energy produced from these wastes, if anaerobic digestion were developed at scale, could be used to replace significant amounts of natural gas usage directly without any significant changes in end use necessarily (such as in high-temperature heating applications) across the Nigerian energy system in the transportation, commercial, residential, industrial and agricultural sectors. The exploration of alternative energy sources such as anaerobic digestion will be important in diversifying the energy mix of Nigeria in the context of its increasing energy demand and economic expansion. This potential is expected to rise in the future due to increasing levels of waste generation, driven mainly by income growth, migration and urbanization. This biogas could also be used to produce hydrogen in the reforming of biogas vapour, making it a potentially useful component of in the decarbonization of difficult-to-decarbonize sectors.

➤ *Contextualizing Nigeria's Industrial Aspirations*

Nigeria's geographic location, abundant hydrocarbon reserves, and youthful demography make it an economic powerhouse in Africa. The nation's aspirations for rapid industrialization are well-founded, driven by the desire to diversify its economy, create jobs, and elevate living standards. However, these aspirations arrive at a crossroads where addressing climate change and environmental degradation is paramount. The solution lies in a holistic and sustainable energy transition that reduces dependence on fossil fuels, curtails greenhouse gas emissions, and propels Nigeria towards a green and resilient industrial future.

➤ *The Imperative of Sustainable Energy Transition*

Globally, the energy landscape is shifting. Climate change concerns, dwindling fossil fuel reserves, and the cost competitiveness of renewable energy sources have catalyzed a worldwide transition towards sustainable energy systems. Nations worldwide recognize that sustainable energy transition is not merely an environmental responsibility but also a strategic imperative for economic growth, energy security, and societal well-being.

➤ *Nigeria's Current Energy Landscape*

Understanding Nigeria's current energy landscape is pivotal for developing effective sustainable energy transition options. Historically, Nigeria has been reliant on fossil fuels, particularly oil and natural gas, as primary energy sources. The oil sector has been a cornerstone of the economy, contributing significantly to government revenue and foreign exchange earnings. Nevertheless, this dependence has presented challenges, including economic vulnerabilities tied to oil price fluctuations.

➤ *Renewable Energy Potential*

Intriguingly, Nigeria boasts abundant renewable energy resources. Solar energy potential is substantial, with northern regions enjoying high solar irradiance. Coastal areas offer wind energy potential and several rivers present hydropower opportunities. However, harnessing these resources necessitates strategic planning and investments.

➤ *Renewable Energy and Energy Efficiency; Climate Change Lessening Stratagem*

The Inter-government Panel on Climate Change (IPCC), a body set up in 1988 by the World Meteorological Organization and the United Nations Environmental Programme to provide authoritative information about the climate change phenomenon, asserts that the warming of the last 100 years was unusual and unlikely to be natural in origin (Bassam Fattouch, R. P. 2018). The IPCC has attributed the warming of at least the second half of the century to an increase in the emission of greenhouse gases into the atmosphere. Human activity is largely responsible for the emission of these gases into the atmosphere: CO₂ is produced by the burning of fossil fuels (coals, oil, gas) as well as by land-use activities such as deforestation; methane is produced by cattle, rice agriculture, fossil fuel use, and landfills; and nitrous oxide is produced by the chemical industry, cattle feed lots, and agricultural soils. As humans have increased their levels of production and consumption, greenhouse gas emissions have also increased; since 1750, at the time of the industrial revolution, CO₂ emission has increased by 31%, methane by 15%, and nitrous oxide by 17%. Moreover, the emissions of these gases continue to rise steadily. The Clean Development Mechanism (CDM) was integrated into the Kyoto Protocol as the United Nations Framework Convention on Climate Change. CDM projects allow investment by entities from industrialized countries into projects in developing countries. In return for this investment, carbon credits (in this case, certified emission reductions) are received by the investor in the industrialized country. This enables the industrialized country to meet its emission reduction targets given by the Kyoto Protocol more cost-effectively while promoting sustainable development in developing countries. CDM projects may also be unilateral, i.e., they take place in a developing country without a project partner from an industrialized nation. Investment in clean energy facilities is recognized as the best way to increase the participation of Nigerian proponents in the CDM process and hence the global carbon market. Clean energy investment is defined as follows: investment into an energy supply and utilization system that provides the required energy with minimal negative environmental and social consequences. Investment into clean energy systems can also be viewed as an investment into energy sources and technologies that are significantly less environmentally damaging than in the status quo case. Investment into clean energy systems provides the most effective and optimally efficient path to an increased CDM participation in Nigeria and hence effective participation in the global carbon market (Energy Transitions: Past and Future; World Economic Forum).

➤ *Policy and Regulatory Framework*

The development and implementation of a robust policy and regulatory framework constitute the linchpin of a successful energy transition strategy. Nigeria must establish clear and attainable renewable energy targets, create mechanisms to encourage the adoption of clean energy technologies and streamline regulations to facilitate private sector investment. Regulatory stability and transparency are essential to attract domestic and foreign investments in the renewable energy sector, driving innovation and job creation.

➤ *Incentives and Financing*

Financial incentives, subsidies, and tax breaks are potent tools for stimulating investment in sustainable energy projects. Nigeria should explore a spectrum of financial instruments and mechanisms to bridge funding gaps and support the implementation of renewable energy projects. Furthermore, fostering partnerships with international organizations and financial institutions can provide access to much-needed capital and technical expertise.

➤ *Technology Transfer and Capacity Building*

To ensure the seamless adoption of sustainable energy solutions, Nigeria must invest in technology transfer and capacity-building programs. This includes empowering the local workforce through training and upskilling, fostering research and development initiatives, and promoting collaboration between academia and industry. A well-trained workforce is indispensable for the successful implementation and long-term maintenance of renewable energy systems.

➤ *Infrastructure Development*

An upgraded and resilient energy infrastructure is fundamental for the seamless integration of renewable energy sources into Nigeria's industrial sector. This encompasses strengthening the power grid, developing efficient transmission and distribution systems, and investing in energy storage solutions. A robust infrastructure ensures the reliability and resilience of energy supply, especially as the energy mix undergoes significant transformation.

➤ *Community Engagement*

Engaging local communities in sustainable energy projects is a cornerstone of successful implementation. It ensures social acceptance, encourages local ownership, and promotes equitable distribution of benefits. Moreover, addressing potential concerns and aligning energy projects with community needs and aspirations is vital for building trust and fostering support.

➤ *International Collaboration*

Collaboration with international organizations, governments, and industries experienced in sustainable energy transition can provide Nigeria with access to expertise, cutting-edge technologies, and funding opportunities. Such partnerships facilitate knowledge exchange, promote technology transfer, and enable the

adoption of global best practices, thereby accelerating progress.

➤ *Monitoring and Evaluation*

A robust monitoring and evaluation system must be established to track progress, assess the effectiveness of policies and projects, and facilitate data-driven decision-making. Regular reviews and assessments ensure that the energy transition remains on course and that adjustments can be made as needed.

➤ *Adaptability and Flexibility*

Nigeria's energy transition journey must be characterized by adaptability and flexibility. Emerging technologies, changing market dynamics, and evolving regulatory frameworks may necessitate adjustments to the strategy. An agile approach that can accommodate these shifts is critical for long-term success.

➤ *Challenges in the Energy Sector; Sustainable Energy Transition:*

Nigeria's energy sector grapples with chronic underinvestment, inadequate infrastructure, and an unreliable power supply. Frequent power outages hinder industrial productivity and economic growth. Moreover, disparities in energy access persist, with rural areas facing significant energy poverty.

The path to sustainable energy transition in Nigeria is multifaceted. It necessitates coordinated efforts from government entities, private enterprises, civil society, and international collaborators. This research paper serves as a comprehensive guide, exploring in-depth the various facets of this transition, from understanding the current energy landscape to tapping into renewable energy potential, crafting enabling policies, fostering financial mechanisms, and engaging communities (ECN, 2005).

IV. RECOMMENDATIONS

In this study, it is established that renewable energy and energy transition are two components that should go together to achieve industrialization in Nigeria. The need to start using renewable energy products and the appropriate practices is essential for industrial growth (Shell. 2021). Therefore, it is recommended that the country should do the following:

- Develop policies on energy efficiency and integrate them into the current energy policies.
- A comprehensive and coherent energy policy is essential in guiding the citizens towards an efficient usage of renewable energy resources.
- Promote energy-efficient products and appropriate practices on the side of the end users and energy generation.
- Create awareness of renewable energy and energy efficiency.
- Establish an agency to promote the use of energy-efficient products and ensure the appropriate practices.
- Develop and imbibe renewable energy technologies.

- Carry out a resource survey and assessment to determine the total renewable energy potential in the country as well as identify the local conditions and local priorities in various ecological zones.
- Establish a testing and standards laboratory for renewable energy technologies similar to that in South Africa.
- Take advantage of global partnerships, such as the Residential Energy Efficiency Project initiative of a country like the UK to assist Nigeria in a creative integration of renewable energy systems.
- Establish a renewable energy funding/financing agency such as India's Indian Renewable Energy Agency.
- Develop appropriate drivers for the implementation of energy efficiency policies.
- Clean energy facilities should be embraced in the different sectors of the Nigerian economy. In the following, a partial list of potential clean energy opportunities in Nigeria is presented: More efficient passive and full usage of solar technologies in the residential, commercial, and industrial sectors. Biogas from wastes as a source of cooking fuel in homes, Use of biofuels inefficient cooking stoves and lamps in homes, Use of compressed natural gas (CNG) as a transport fuel, Use of biofuels as transport fuel.
- Use of solar and wind energy for irrigation water pumping and farm electricity supply, Utilization of agricultural residues for electricity generation, Generation of biogas from wastes produced by the livestock and animal husbandry.
- In addition to these, the existing research and development centers and technology development institutions should be adequately strengthened to support the shift towards increased use of renewable energy. Human resource development, critical knowledge, and know-how transfer should be the focus for project development, project management, monitoring, and evaluation; The preparation of standards and codes of practices, maintenance manuals, life cycle costing, and cost-benefit analysis tools should be undertaken as an urgent priority.

V. CONCLUSION

Nigeria's pursuit of rapid industrialization holds tremendous promise for the nation and the African continent at large. Nevertheless, this endeavor must be underpinned by sustainability, inclusivity, and adaptability. Sustainable energy transition emerges as the cornerstone, offering not only economic prosperity but also environmental preservation and energy security. This research paper, through its comprehensive exploration of the subject matter, illuminate the path forward, empowering Nigeria to navigate the complexities of sustainable energy transition successfully. In doing so, Nigeria can serve as a beacon of progress for Africa, contributing to global efforts to combat climate change while achieving remarkable industrial growth.

In addition, energy transition is here with us. As with other transitions, it is a journey that will involve multiple

approaches, and collective action and undoubtedly present new challenges and opportunities. Nigeria is well positioned to ride the wave of the current energy transition with its abundance of natural fossil fuels and renewable solar energy. Thus, she Needs to move with a greater sense of urgency and a clear sense of direction. In this era of massive investments in low-carbon energy options and the rapid buildout of technologies that have never been deployed in the country. We look forward to seeing the research that will build these low-carbon technologies and lead Nigeria into the emerging decades where renewable energy takes more prominent role in the energy mix, thereby creating more economic opportunities for Nigeria and Nigerians.

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