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TRANSITIONING TO RENEWABLE ENERGY IN NIGERIA: CHALLENGES AND OPPORTUNITIES IN THE POST-FUEL SUBSIDY ERA

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Abstract

The formal removal of subsidy on fuel by the Federal Government of Nigeria on 29th May, 2023, presents a unique opportunity for both the Federal and State Governments to transition towards alternative renewable energy sources. This shift is imperative and critical in order to reduce greenhouse gas emissions, improve access to energy, enhance energy security, and facilitate sustainable development. However, the transition also poses significant challenges. This paper examines the opportunities and challenges associated with Nigeria's transition to renewable energy post-subsidy removal. Using the Institutional Theory (IT) and the Transition Management Theory (TMT), the paper analyses the current energy landscape of Nigeria, the political will of the government, institutional, legal and the policy and regulatory frameworks governing the energy sector. The findings emphasize the need for a coordinated policy approach; massive investments in energy infrastructure and technology; aggressive public awareness, sensitization and mobilization of the people; and key private and public sector operators to embrace, support, and drive the transition to renewable energy. The paper concludes that Nigeria's transition to renewable energy requires multi-stakeholders' efforts and sustained commitment to addressing the challenges and leveraging the opportunities presented by the shift in order to fast track Nigeria's sustainable development.

***Keywords*:** renewable energy, subsidy removal, energy democracy, sustainable energy, sustainable development

Introduction

The idea of subsidy and subsidization is not new. It is an important component of government expenditure profile in both developed and developing economies. All over the world, political and economic history is replete with evidence of the use of subsidies by governments as economic instruments of intervention to keep the prices of certain products, commodities or services “artificially" low in some industries or sectors of the economy, especially agriculture, health, education, energy and some social services, rather than allowing market forces to dictate their prices. This is perhaps informed by the Keynesian theory which advocates active state intervention or participation in the economy. Primarily, this is to encourage and improve the production, supply and availability of such goods and services. Thus, with subsidies as incentives, which may be in form of cash, grants or tax reliefs, etc; consumers and the public can have access to cheaper products, commodities and services. Unfortunately, the efficiency and fiscal sustainability of subsidies have been questioned by some scholars (Onyekwena & Eghosa, 2019). They are also seen as channels of economic and fiscal leakages, waste and corruption.

The application of subsidies dates back to ancient civilizations, where governments were constrained by prevailing economic circumstances to provide support to farmers (mostly peasants), traders and artisans in order to promote economic growth and activities.

For instance, in ancient Greece, the government provided subsidies to farmers to encourage agricultural production. Also, during the Middle Ages, European governments offered subsides to merchants and traders to promote trade and commerce (Hansenl, 2006; Braudel, 1982). It has been reported that "the EU spends about 40% of its budget (some $60 billion) in subsides for farmers" and "the rich countries of the organisation for Economic Cooperation and Development (OECD) (a group of high- income countries) spend close to US $1 billion a day on agricultural subsidies or about US $300 billion a year" (Olomola, 2005, p. 10). Norway, Switzerland and Iceland have the highest national average rates of 65-75% of the value of production on subsidy across all major commodities. In Japan and Korea, the support is about 60-65%. The United States, Philippines and Indonesia also heavily subsidize most agricultural products. With respect to Nigeria, fuel subsidies started in the 1970s. It is estimated that between 2020 to 2023, the Nigerian government spent a whopping amount of N16.4 trillion on subsidies and subsidised fossil fuel to the tune of about $3.9 billion (Munshi, 2018).

On 29th May,2023, the President and Commander-in-Chief of the Armed Forces of the Federal Republic of Nigeria, Bola Ahmed Tinubu, during the presentation of his Presidential Inauguration speech, formally announced the removal of subsidy on petroleum products by the Federal Government. The announcement was received with mixed feelings by both the Nigerian public and the international community, especially given that government did not put in place social safety nets and other measures to absorb or accommodate the negative fallouts and impacts of the subsidy removal. That singular action resulted, inter alia, in astronomical or meteoric increase in the price of petroleum products, particularly the petroleum motor spirit (PMS), otherwise known as fuel, and limited its access to many Nigerians and non-Nigerians, including domestic and business consumers. It also heightened inflation and further weakened the exchange of the naira to the dollar. These brought again to the fore, the urgent and compelling need to explore the possibility of enhanced access to available and affordable alternative renewable energy. This is not only with the intention to improve the living conditions of Nigerians, but to also drive and facilitate the process and pace of the progress, prosperity and sustainable development of the people and the country.

Recently, the African Heads of State in collaboration with the African Development Bank (ADB) and the World Bank, held a Summit in Tanzania on "Mission 300". The initiative seeks to provide electricity access to 300 million people in Africa by 2030; accelerating energy access in underserved regions, renewable energy, energy efficiency and mobilizing private sector investments. President Tinubu, among other African Heads of States, attended the Summit. This, once more, resonated the importance of alternative renewable energy for Africa's development in general and Nigeria in particular.

In the light of the foregoing, the relevant question to be asked at this point is: What are the opportunities and challenges available for Nigeria's transition to renewable energy post-subsidy removal? Against this backdrop, the principal objective or focus of this paper is to examine Nigeria's energy landscape in the context of the necessity, opportunities and challenges in transitioning to renewable energy for Nigeria's post-subsidy removal.

Research Methods

This paper being qualitative research, relied on secondary sources of data collection such as books, Journals, encyclopaedia, reports, legislation, digital or online sources and other relevant publications. Qualitative content analysis method was used to analyse and interpret the data obtained.

Theoretical Framework

For analytical purposes, this paper will rely on two theoretical frameworks: the Institutional Theory (IT) and the Transition Management Theory (TMT).

The institutional theory emphasises the role of institutions, not only in shaping the political behaviour of actors and outcomes, but also in influencing the transition process.

The key assumptions of the institutional theory are that institutions perform specific functions, determine behaviour and outcomes, provide incentives and stability. They are also interdependent and work in synergy with others to achieve specified goals and objectives. Transitioning to renewable energy in Nigeria cannot be carried out by a single government institution or agency, but by the collaboration of key and strategic institutions and agencies. They include the Ministries of Innovation, Science and Technology; Water Resources; Power; Petroleum Resources; Environment and relevant agencies and commissions.

The major proponents of the institutional theory include James March and Johan Olsen, who developed the concepts of "new institutionalism" and "normative institutionalism". Normative institutionalism focuses on the moral and ethical dimensions of institutions and the need for institutions to promote social justice, equality and human well-being. Other votaries of the institutional theory are Douglas North, Paul Person and Rod Rhodes, etc. (Marsh & Stoker, 2002; Kalagbor, 2001).

With respect to the Transition Management Theory (TMT), the theory focuses on the process of transitioning from one socio-technical or technological system to another. It is a theoretical framework used to understand, manage and analyse complex and long-term policy transitions such as energy transitions, transportation policies, agriculture, healthcare reforms, etc. The theory, among others, recognises multi-level perspective (micro-level such as individuals and organizations, meso-level like networks and institutions and macro-level such as societal and global). It stresses the co-evolution of technology, institutions and user practices, which can lead to the emergence of new systems and regimes; multi-actor involvement and highlights the importance of governance and institutional change in managing transitions, including the role of governments, corporations and civil society organizations in transition processes. Some of the main transition management theorists include Dutch researchers and scientists, Jan Rotmans, Derk Loorbach and Rene Kemp who developed the theory in the 2000s.

The TMT is relevant to this paper in several ways. It will help in the analysis of the complex transition to renewable energy at both the micro, meso and macro-levels in Nigeria as well as examine the role of critical stakeholders in the process, especially the relevant federal ministries, commissions and agencies of government as well as other stakeholders who are not only major policy making, advisory, implementation organ and regulator of the energy sector in the country but users and beneficiaries of the sector (Loorbach, 2018; Potmans & Loorback, 2017; Geels, 2020).

Conceptual Clarifications

For the purpose of conceptual classifications and in the context of this paper, the following concepts will be examined: renewable energy, subsidy and subsidy removal.

Conceptualising Renewable Energy

"Energy is like the blood of modern civilisation" (Asuka & Jin, 2022, p. 4). The "Science of energy" is referred to as thermodynamics, and "the chief practical purpose of thermodynamics is to learn how energy can best be harnessed to work-requiring tasks" (Commoner, 1977, pp. 6 & 21).

Energy is an indispensable resource and plays a key role in the improvements of the standard and living conditions of people, the establishment, growth and sustenance of businesses, including effective and efficient service delivery; enhancing the process of

industrialization, economic diversification as well as facilitating economic growth, stability prosperity and the overall sustainable development of any country. Considering the importance, relevant and centrality of energy to development, the 2030 agenda for sustainable development, which was adopted by the United Nations in 2017, on Sustainable Development Goals (SDGs), number 7, provides for "affordable and clean energy" (United Nations, 2017). The term "energy" is distilled from the Greek word, "energeia", which means "activity". Generally, energy is the ability or capacity to do work, carry out an action or cause a change" (Darity, 2008; IEA, 2020; EIA, 2020).

Furthermore, the International Energy Agency (IEA) has defined energy as, "the driving force behind economic growth, social development, and human progress, and it is essential for meeting basic human needs such as lighting, heating, cooking and transportation. (IEA, 2020, p. 15). There are many forms of energy: Kinetic energy, potential energy, chemical energy, mechanical energy, nuclear energy and gravitational energy. Energy may also be physical, artificial, spiritual energy; electromagnetic energy, thermal energy (associated with temperature of an object); sound energy, intellectual energy, renewable and non-renewable energy, etc. (Smil, 2017; Twidell & Weir, 2015; EIA, 2020).

Renewable energy is an alternative source of energy to fossil energy or fossil-based energy, like coal, oil and natural gas. The International Energy Agency has defined renewable energy to mean "energy that is derived from natural processes that are replenished constantly, such as sunlight, wind, rain, and geothermal heat (IEA, 2020, p.12). Renewable energy sources replenish themselves naturally overtime and as such, they are said to be infinite. Types of renewable energy are solar energy, wind energy, hydro energy, and geothermal energy. Others include bioenergy (obtained from natural sources such as wood residues; agricultural residues like sugarcane wastes and animal husbandry residue like cow dung) and ocean energy, which is harnessed from wind and wave, etc. Some of the principal benefits of renewable energy are mitigation of climate change such as drastic reduction of green house gas emissions; enhancement of energy security intended to reduce the risks associated with price volatility and improvement of air and water quality by reducing the negative impact of fossil fuel combustion on human health and the environment (IEA, 2020; IPCC, 2013; IRENA, 2020; World Health Organization, 2018; Twidell & Weir, 2015).

Renewable energy sources are sustainable and account for the reference to them as "sustainable energy", not withstanding that renewable energy and sustainable energy are not exactly the same. Renewable energy sources are sustainable, but not all sustainable energy sources are renewable. Thus, whereas renewable energy refers to energy that is generated from natural resources that can be replaced or replenished overtime, sustainable energy is concerned with energy that is generated and used in such a way that it reduces harm to the environment, including the people and promotes socio-economic, environmental and political development. Therefore, sustainable energy is more about energy efficiency, energy conservation and environmental harm minimisation or minimal environmental impact. Again, renewable energy is limited to sources, but sustainable energy encompasses both renewable energy and non-renewable energies, including fossil fuel (IEA, 2020; IRENA, 2020).

In consideration of the above Tester (2005), defined sustainable energy as, "a dynamic harmony between the equitable availability of energy-intensive goods and services, the environment and the finiteness of primary energy sources" (P2). Similarly, sustainable energy has variously been defined as "energy that is accessible, reliable and environmentally friendly" (IEA, 2020, p. 12); "Energy that meets the needs of the present without compromising the ability of future generations to meet their own needs" (United Nations, 2015, p.12) and "Energy that is economically viable, socially acceptable and environmentally friendly" (World Energy Council, 2019, p.15).

Renewable energy is considered both as green and clean energy. Renewable energy is called "green" energy because it is obtained from natural sources and have minimal adverse

environmental impact. On the other hand, renewable energy is termed "clean" energy for the reason that it is produced from sources with least environmental impact. In other words, it produces significantly fewer greenhouse gas emissions and other pollutants when compared to fossil-based energy sources (NREL, 2020; IEA, 2020).

Subsidy

Subsidy is derived from the Latin word, "Subsidium", meaning "support, assistance or help". Generally, subsidy is a form of government subvention, intervention and incentive. It is a privileged financial aid. Ogwuche, et al. (2024) have defined a government subsidy as "a measure that lowers the price that consumers pay for consumption or raises the price that producers charge for their goods. A subsidy is a policy that maintains consumer prices for goods or products at or above producer market prices" (p. 4). Todaro and Smith (2015) add that subsidy is "a payment by the government to producers or distributors in an industry for such purposes as preventing the decline of that industry, expanding employment, increasing exports or reducing selected prices paid by consumers" (p. 837). From the angle of the International Monetary Fund, (2013), "a subsidy is a direct or indirect financial contribution by a government or other financial entity to private sector entity, with the objective of influencing the production or consumption of goods and services, or the allocation of resources in the economy" (p. 12).

From the above, it can be inferred that subsidies may be private or public, direct or indirect (e.g. tax breaks, holidays, reliefs, exemptions or students' grants/loans). Subsidies in many instances take the form of cash transfers and grants. In terms of typology, subsidies can be export subsidy, to support exports and promote international trade; agricultural subsidy to encourage agricultural production, productivity and promotion of food security; rental subsidy, wage subsidy and energy subsidy. Aside from price reduction, subsidy also promotes economic growth, encourages innovation and provides support for vulnerable groups such as farmers, low-income earners and households, small businesses, students the aged and the unemployed, etc.

Assessing the implications of the politics of fuel subsidy regime in Nigeria, Uwak, Ekpenyong and Edem (2024) reinforced and reiterated that subsidy is:

> A financial contribution provided by the government, state or an organization to assist an industry, individual or public officials in maintaining lower prices for certain goods or services. It can also be considered as a financial grant from the government or parliament to the state for addressing specific needs. A subsidy represents a concession or privilege granted either directly or indirectly by the government to businesses, households or other government entities to achieve a public goal. (p. 56)

The Keynesian theory advocates active state participation and intervention in the economy and economic activities. Flowing from this, pro-subsidy economists, scholars and apologists argue that provision of subsidy by government in a given sector, industry or service can help to support the growth of businesses in such areas, promote economic growth and enhance the living conditions of a greater portion of the population. On the other hand, anti-subsidy scholars argue, among others, that subsidy distorts market dynamics leading to inefficiencies; diverts investment of financial resources in critical sectors of the economy and breeds corruption in government, especially among the political elite, bureaucrats and private sector operators. They strongly contend that prices of goods and services should be determined surplus, from its reserves to fund subsidies or other strategic and critical investments or future savings (Ozili & Obiora, 2023; Ovaga & Okechukwu, 2022).

Subsidies can also be classified into production subsidy and consumption subsidies. They are types of government subsidies that serve different purposes and have different impacts or effects on the economy. Production subsidies are classified as payments or

incentives which are provided by government to producers, manufactures or suppliers of goods and services. The principal aim of production subsidies is to increase the production of specific goods and services, with the intention of supporting domestic industries, promote economic growth and other social objectives, including social welfare. Agricultural and export subsidies and research and development subsidies are examples of production subsidies. On the other hand, consumption subsidies are payment or incentives provided by government to consumers or end-users of goods and services which are aimed at increasing the consumption of specific goods and services, often to support low-income households or earners, promote social welfare or achieve environmental and cultural objectives, provision of food stamps (e.g. vouchers or debit cards) to low-income households and students to purchase food at reduced prices. Energy and health care subsidies are classic examples of consumption subsidies.

Accordingly, while production subsidies target producers and manufacturers and aim to increase production; consumption subsidies focus on consumers and aim to increase consumption. However, the two types of subsidies could have negative effects because production subsidies can lead to overproduction, whilst consumption subsides can result in overconsumption and waste (Stiglitz & Rosengard, 2015; Krugman & Obstfeld, 2018; Bhagwati, 2017). Substitutes that are provided to support general or social services such as education or healthcare is known as “general services subsidies”. Subsidies can equally take the form of price subsidies (e.g. Price controls or ceilings); quantitative restrictions on imports or exports and regulatory subsides, including licensing requirements and zoning regulations.

Concept of Subsidy Removal

Subsidy Removal is also known as subsidy reform or subsidy elimination. The World Bank has always emphasized on the need for the reduction or elimination of government subsidies that are considered inefficient, ineffective or unsustainable. This is because subsidy removal can facilitate the actualization of sustainable development goals. Subsidy Removal is a deliberate policy, decision or action by government to withdraw subsidy, financial or other support to a given sector, product-type or service, thereby allowing market forces of demand and supply to determine and dictate the prices of such product or service. According to the International Monetary Fund (IMF), subsidy removal is “the elimination or reduction of subsidies that are provided by the government to support the production or consumption of goods and services". (IMF, 2013, p. 12) Correspondingly, Katz (2013) is of the view that “subsidy removal refers to the process of eliminating or reducing government subsidies that are provided to support the production or consumption of goods and services”. (p. 252) Nigeria is not the first country to remove subsidy. “In 1997, Indonesia removed fuel subsidy after the Asian financial crises” (Ozili & Obiora, 2023, p.5). Many other countries at one point or the other had also removed subsidies, including Angola, Kenya and Ghana in Africa. Outside Africa and apart from Indonesia, Italy, Ukraine and Thailand have reduced fuel subsidies in recent years.

Some of the benefits of removal or withdrawal of the subsidy is that it reduces fiscal burden on government and frees up financial resources for investments in critical sectors of the economy, particular in infrastructure, thereby increasing the revenue of government. It also has the potentials to promote economic efficiency by allowing market forces to determine market prices and allocation of resources. However, subsidy removal can have certain negative effects, some of which include price increases which may affect access to essential goods and services, consumption patterns and economic activities. It could also have negative social impacts, particularly on vulnerable populations, such as the poor, low-income households and earners (IMF, 2013; Rodrik, 2015).

The Nigerian Energy Sector: Institutional, Policy, Legal and Regulatory Frameworks

The energy sector in Nigeria is vast and covers various energy sources such as petroleum, natural gas, electricity, coal and renewable sources. It is governed by a complex set of system of multiple policies, legal, regulatory and other frameworks. The key components are as follows:

1) Institutional Frameworks

The energy sector is overseen by various Federal Government ministries, departments and agencies (MDAs), namely:

a) Federal Ministry of Innovation, Science and Technology
In relation to the energy sector, the ministry is responsible for promoting the development and use of renewable energy sources to reduce Nigeria's dependence on fossil fuels and mitigate climate change, energy research and development to improve the country's energy mix and promote innovation in the energy sector (FMST, 2020);

b) Federal Ministry of Water Resources
The Ministry is responsible for the development and management of Nigeria's water resources. In relation to the energy sector, the ministry is responsible for the development and management of hydro power resources and water supply for energy generation, prevent water scarcity and support energy security, etc. (FMWR, 2020);

c) The Federal Ministry of Power is responsible for initiating and formulating policies for the co-ordination and development of the power sector;

d) The Federal Ministry of Petroleum Resources oversees the petroleum industry (oil and gas);

e) Federal Ministry of Environment is responsible for policy making and co-ordination of the environment, including environmental protection and climate change;

f) Nigerian Electricity Regulatory Commission (NERC)
The NERC is the independent regulatory power agency for regulating the electricity power industry in Nigeria. The powers and functions of NERC were provided in the Electric Power Sector Reform Act, (EPSR), 2005, which was repealed and replaced with the Electricity Act, 2023. The powers and functions of the Commission include licensing operators; tariff regulation, standardization for electricity generation, transmission and distribution, enforcement of compliance, monitoring and evaluation, dispute resolution and policy development. Others are protection of consumers' interests, especially by ensuring that they have access to reliable and affordable electricity, promotion of competition in the electricity industry in order to ensure efficiency and effectiveness of operators and ensuring safety in the industry (EPSRA, 2005; EA, 2023); and

g) Energy Commission of Nigeria (ECN)
The ECN is responsible for strategic planning and coordination of the national energy policies. This Commission is domiciled in the Ministry of Innovation, Science and Technology.

2) Legal Instruments and Regulations

The 1999 Constitution of the Federal Republic of Nigeria (as amended),is the supreme law of the country and serves as the principal legislation governing the energy sector in Nigeria. It provides the overall framework for the governance of the energy sector.The applicable provision of the Constitution in section 44 (3), which vests the entire property in and control of minerals, mineral oil and natural gas in, under or upon any land in Nigeria, or in, under or upon the territorial waters and the Exclusive Economic Zone of Nigeria in the Government of the Federation. Laws and instruments which provide detailed guidelines on the management and regulation of the energy sector in Nigeria are derived from the Constitution (The 1999 CFRN).

There are key laws and instruments governing the energy sector in Nigeria. They include:

- The Electricity Act, 2023 (Formerly Electric Power Sector Reform Act 2005).
  The Electricity Act provides a comprehensive legal and institutional framework for the power sector in Nigeria and recognises the integration of renewable energy into Nigeria's energy mix to attract investments.
- National Electric Power Policy (NEPP) 2001. The NEPP outlines the Federal Government's policy for the power sector.
- National Energy Policy, 2003, provides a framework for the development of the energy sector.
- Petroleum Industry Act, 2021. The Act provides a consolidated legislation regarding all aspects and a comprehensive framework for the governance, administration and regulations of the petroleum industry in Nigeria, covering areas such as upstream, midstream and downstream operations, host community development and fiscal framework. Some of the key provisions of the Act include the establishment of the Nigerian Upstream Regulatory Commission, the Nigerian Midstream and Downstream Petroleum Regulatory Authority and the proposal of a 3%-5% equity stake for host communities and the restructuring of the Nigerian National Petroleum Corporation (NNPC) (The Petroleum Industry Act, 2021).

Policy Initiatives

The Federal Government has introduced many policy initiatives to promote the development of Nigeria's energy sector, to wit:

- Nigeria Electrification Programme (NEP)
  It aims at providing electricity access to households and businesses in off-grid communities. Off-grid communities are communities that are not connected to the main electrical or energy grid. Such communities may be self-sufficient and rely on their own infrastructure and energy resources, such as renewable energy sources. They exist all over the world, including in rural areas.
- Power Sector Recovery Programmes (PSRP)
  The PSRP aims at the restoration of the financial viability of the power sector
- National Renewable Energy and Energy Efficiency Policy (NREEEP).
  The NREEEP aims to promote the use of renewable energy and energy efficiency.
- The Nigeria Renewable Energy Master Plan is a policy which aims at increasing the use of renewable energy in Nigeria. The implementation of the plan is driven by the Federal Ministry of Environment, etc.

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III. National Renewable Energy and Energy Efficiency Policy (NREEEP).
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IV. The Nigeria Renewable Energy Master Plan is a policy which aims at increasing the use of renewable energy in Nigeria. The implementation of the plan is driven by the Federal Ministry of Environment, etc.

Renewable Energy Strategies in the Context of Post-Subsidy Removal

Nigeria, no doubt, is faced with energy poverty, among other forms of poverty. With reference to Moniruzzaman, Aransi et al. (2020) identified four basic approaches to defining energy poverty, namely: "expenditure-based, amount of energy used, the income of households and access to clean energy (p. 590).

Commenting on the energy poverty in Nigeria, Kalagbor and Sam-Kalagbor (2024) observed that:

> With epileptic electricity supplies in the urban areas, absence of electricity in many rural communities, irregular maintenance of the national grid, astronomical rise in electricity tariff, price of fuel, diesel and gas, particularly as a result of the removal of subsidy on petroleum products, life has become very difficult for many Nigerians and business operators...Alternative sources of energy supply such as gas, clean energy and green energy are yet to be developed and made available, stable, reliable, affordable and accessible to many Nigerians. (p. 143)

Considering the above observation, particularly the increasing costs and adverse socio-economic impacts of withdrawal or removal of subsidy on fuel on individuals, businesses and indeed the entire Nigerian economy, fuel being a critical energy driver of the Nigerian economy, transitioning fully to renewable energy sources becomes inevitable and a desideratum. This is because renewable energy technologies and solutions are critical for Nigerians energy future, economic diversification and sustainable development. Their adoption can be accelerated in a post-subsidy era. A firm and committed political leadership and will by the Federal Government are required to effectively drive full transition to renewable energy in Nigeria, all other things, being equal. Strong institutional capacity of the various ministries, departments and agencies of government responsible for energy policy formulation, implementation, evaluation and coordination of various policies, initiatives, plans and regulations must be activated and strengthened for optimum performance efficiency and effectiveness. In particular, the Ministry of Innovation, Science and Technology, which is principally responsible for promoting the development and use of renewable energy resources to reduce Nigeria's reliance on fossil fuels and mitigate climate change; enhance energy research and development to improve Nigeria's energy mix and promote innovation in the energy sector, must as a matter of prime priority and necessity, actively and effectively drive and sustain the transition process. This, it should do in collaboration with other relevant ministries such as the Federal Ministries of Petroleum Resources, Water Resources, Power and Environment as well as apposite commissions and energy-related agencies.

The formal and informal sectors of the Nigerian economy and the entire Nigerian public, including community leaders and those in the diaspora, states and local governments should be educated, conscientized and effectively mobilised to embrace and support the transition to and use of renewable energy for domestic business or commercial, industrial and other purposes, because of its huge benefits. As a matter of policy priority, the Federal Government should direct, encourage and support public institutions and senior public office holders (elected and appointed) at various levels, to resort to the use of renewable energy within a given timeline to demonstrate its seriousness and unwavering commitment to the transition. State and local governments should be in the vanguard of the drive for transition to renewable energy, especially in rural communities. This will go a long way to reinforce the interest of the people in the project, enhance the energy mix in the country and provide alternative access to available, affordable and sustainable energy sources to the people, capable of stimulating socio-economic growth and overall development of both the people and the country.

Opportunities and Benefits

The transition to renewable energy in Nigeria has the potentials to create great opportunities for and confer certain benefits on individuals, households, businesses and the entirety of the Nigerian economy. Some of the Key opportunities and benefits are as follows:

1. Enhanced Energy Security and Independence
   The International Energy Agency (IEA) (2019) defines energy security as "the uninterrupted availability of energy sources at an affordable price" (p. 15). This means that energy must not only be available and affordable, it must also be reliable and sustainable. Renewable energy also reduces dependence on imported and locally produced fossil fuel, which has adverse impact on the environment (World Energy Council, 2019).
2. Reduced Energy Costs and Improved Energy Access
   Renewable energy sources have the capacity to reduce energy costs or prices in the long run as the costs of renewable energy technologies and solutions have continued to decline globally. There is also the possibility of improved access to energy by a greater proportion of the population, including rural communities and "undeserved" areas.
3. Socio-economic Development
   In generic terms, energy and in this context, renewable energy sources, remain key drivers of socio-economic growth and development in Nigeria. They provide opportunities for facilitating and regenerating economic activities, enhanced industrialization, employment generation and poverty reduction. Rural development can also be vigorously pursued, including agricultural production and productivity to increase food production and ensure food security for Nigerians (IREA, 2020).
4. Mitigation of Climate Change and Environmental Health Impacts
   Renewable energy sources significantly less green house gases which mitigate climate change, reduce air pollution, thereby help in improving public health and the quality of life of the people (World Health Organization, 2018).
5. Innovation, Technological Advancement, Flexibility and Adaptability
   Renewable energy technology and solutions has the capability to drive innovations and technological advancement, including autochthonous technological development as well as provide flexibility and adaptability in the energy system by integrating the renewable energy sources to the overall energy mix of the country (IREA, 2020; Bloomberg NEF, 2020).

Challenges

It is estimated that over 140 million people lack access to energy in Nigeria, thereby making it challenging to transition to renewable energy sources (WEF, 2023). This in itself is enough reason for the federal government to declare a state of emergency in Nigeria's energy sector. This is capable of ushering in what Asuka and Jin (2022) referred to as "energy democracy". As a developing concept in the energy sector and lexicon, energy democracy represents a radical shift in the production, distribution and control of energy with a focus on community-led, decentralised and renewable energy systems. It emphasises the importance of democratic participation, social justice and environmental sustainability in the energy sector. There are many renewable energy resources available in Nigeria such as solar, wind energies, hydropower, biomass resources, etc. In fact, Nigeria has a high solar radiation level and has made notable and commendable achievements in the renewable energy sector. (IREA, 2020; Onuh, et al., 2024). Nigeria also has abundance of natural gas reserve. Compressed natural gas (CNG) is another area of alternative energy source that has surplus potentials and benefits for exploration and use in Nigeria. Apart from being considerably cheap, compared to fossil fuels, it does not have negative impacts on the environment in terms of greenhouse emission.

On the part of users, especially vehicle users, the use of compressed natural gas can also reduce the cost of vehicle maintenance. Nevertheless, the use of compressed natural gas presents some challenges such as the necessary infrastructure and professional personnel to retrofit, modify or convert existing vehicle engines with CNG-fitted engines. Government also needs to formulate policies to effectively drive the transition to CNG energy sources as well as carry out public education on the potentials and benefits of the use of CNG. Unfortunately, there are many challenges confronting the country in the process of transitioning to renewable energy, especially vis-à-vis Nigeria's post subsidy removal. The challenges include the following:

1. **The Challenge of Political Leadership**
   John Maxwell believes that everything rises and falls on leadership. Chinua Achebe, one of Nigerian's foremost novelist and literary icon, in his famous book, *The Trouble with Nigeria*, instructively noted that:

   > The trouble with Nigeria is simply and squarely a failure of leadership. There is nothing basically wrong with the Nigerian character. There is nothing wrong with the Nigerian land or climate or water or air or anything else. The Nigerian problem is the unwillingness or inability of its leaders to rise to the responsibility, to the challenge of personal example which are the hall marks of true leadership. (Achebe, 1983, p. 1)

   The challenge of leadership is equally applicable to the President of Nigeria, Bola Ahmed Tinubu, with respect to driving the process of transition to renewable energy in the context of post-subsidy removal. The Federal Government under his leadership requires a strong political will, assertiveness, commitment and doggedness to achieve this lofty vision. The president is also required to exert positive influence on the political leadership of the states, local governments and the MDAs to follow suit. Politicisation of the transition to renewable energy must be avoided or eliminated at all costs and by all legal and necessary means.

2. **The Challenge of Institutional Capacity**
   Nigeria's energy sector is coordinated by the Federal Ministries of Innovation, Science and Technology, Power, Petroleum Resources, Environment, Water Resources and several commissions or agencies, respectively. There are also different laws, policies, initiatives and regulations governing the energy sector, and in particular, research, growth and development of Nigeria's renewable energy resources. These make effective co-ordination of the transition to renewable energy sources complex, and arduous. Some of the roles of the ministries, departments and agencies (MDAs) are at times, either conflicting or overlapping and may constitute a serious constraint to the process. There is, therefore, the need to strengthen the institutional capacities of the MDAs and resolve possible areas of policy inconsistencies, inadequacies, role conflicts or overlap to ensure a seamless transition to renewable energy sources in Nigeria's post-subsidy era, especially bearing in mind goal 16 of the United Nations' Sustainable Development Goals (SDGs),“Peace, Justice and strong Institutions”. Germany's successful transition to renewable energy, “Energiewende", was made possible due to the presence of strong institutional framework and multiple levels of governance. In Costa Rica, political stability, strong judiciary and governance transparency aided the success of the transition to renewable energy.

3. The Challenge of Paucity of Funds and Technical Personnel

No doubt, the transition to renewable energy sources requires huge capital investments on the part of government, private individuals and business organizations. The relatively high cost of installation of renewable energy technologies, especially for small households and business operations are demanding. Government, individuals and business organizations need to mobilise the requisite capital to achieve this goal. The current high cost of goods and services in the country, poverty of a significant portion of Nigerians, high exchange rate of the Nigerian naira to the American dollar and difficulty in obtaining capital/credits from financial institutions are genuine concerns. Similarly, the paucity of qualified, competent and experienced technical and other personnel to conduct technical and feasibility studies, instal and maintain renewable energy technologies, provide relevant advisory, consultancy, maintenance and retainership services are critical considerations. In most cases, reliance is likely to be placed on foreign skilled labour or experts. There are also limited and competent indigenous renewable energy technology companies to provide the needed services and to manufacture the requisite renewable energy components and facilities. These have the potentials of resorting to importation of renewable energy technology (Onuh, et al., 2024).

4. The Challenge of Insufficient Infrastructure

Infrastructure is critical to the development and sustenance of renewable energy technology and solutions in Nigeria. Infrastructure refers to the basic systems, structures and networks that provide support for the operation or functionality of a society, economy, polity or organization. In particular, energy infrastructure comprises the physical systems, networks and facilities that are used to generate, transmit, distribute and store energy. They include power plants, transmission lines, pipelines and storage facilities (IEA, 2020). Specifically, renewable energy infrastructure includes solar photovoltaic, including solar panels, inverters and mounting systems; wind turbines, towers and foundations, dams, generators and power plants. Others are biomass power plants, anaerobic digesters, biofuel production facilities, energy storage technologies, advanced metering infrastructure, grid and energy management systems, etc (NREL, 2019).

Energy infrastructure is not only necessitous for the transition to sustainable renewable energy sources, it enables or ensures reliable, efficient supply and access to renewable energy. Unfortunately, available energy infrastructure in Nigeria is grossly inadequate. Government and renewable energy technology investors, local and international, need to massively invest in the provision of large-scale renewable energy infrastructure in the country. Government as a matter of urgency and priority should go into partnership and collaboration with local and foreign renewable energy technology and project investors and developers. China is the largest producer of solar energy, accounting for about 77.8% of the world's solar panels and equipment. China is followed by the United States of America, Germany, India and Japan. Government can give consideration to entering into bilateral agreement with some of these countries, particularly China to facilitate the development of renewable energy resources in the country. Relevant, new or existing policies or initiatives should be rejigged or put in place to attract and encourage such investors to significantly invest in renewable energy projects and technology in Nigeria.

5. The Challenge of Ignorance and lack of Information

Due to ignorance, poor education and public enlightenment, many Nigerians, especially in rural communities, are not aware of the existence and associated

opportunities and benefits of renewable energy resources. Intensive and aggressive public education, enlightenment and mobilisation are required by government to educate Nigerians on the opportunities and benefits of renewable energy and above all, the need to support the post-subsidy removal policies, initiatives and projects of government on transition to renewable energy in the country. One valuable lesson from Denmark's successful renewable energy transition is the importance of public engagements and participation in the transition process (energy democracy) which tremendously helped to build strong support and conferred legitimacy on the transition to renewable energy in Denmark.

Conclusion

The transition or shift to sustainable renewable energy in Nigerian's post-subsidy era uncompromisingly requires a multifaceted and pragmatic strategy. Such an approach must adequately and squarely address the leadership, institutional, financial, personnel infrastructural; ignorance and lack of information challenges, among others, already highlighted in this paper. This will open the gateway to unlock the opportunities and tap the abundant benefits of renewable energy sources and resources to improve the standard and living conditions of the people, boost economic growth and put Nigeria on the glorious path of sustainable development, including a guaranteed energy future. Positive lessons from successful renewable energy transition in countries such as Germany, Denmark and Costa Rica will serve as useful guides and help to identify best practices for Nigeria (Morris & Jungjohann, 2016). There are also valuable lessons to be derived from the experiences of China and Taiwan, among others.

Recommendations

The following recommendations are hereby made:

1. Government should muster firm political will, unwavering commitment and strengthen institutional capacities to drive the transition to its renewable energy in the country, considering its benefits;
2. Government should mobilise huge funds and embark on massive development of energy infrastructure and personnel. This can be done through partnerships and collaborations with reputable renewable energy developers, local and foreign, and selected countries with visible history and evidence of successful transitions to renewable energy sources;
3. Public education and enlightenment on the opportunities and benefits of renewable energy engagements and participation of all critical stakeholders to build a strong support system for the transition to renewable energy should be vigorously pursued by government;
4. All legal lacunae, policy inconsistencies or overlap as well as role or functional overlap and conflicts should be addressed and harmonised by government in order to ensure effective and efficient coordination of the transition process to renewable and sustainable energy in the country; and,
5. Government should encourage and sponsor researches and development studies in renewable energy in research institutions and universities within and outside the country to proffer practical solutions to Nigeria’s energy poverty.

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