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An Assessment of Energy Security and Climate Change in Nigeria

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Abstract

Every stage of the world development is accompanied by increased demand for energy and consequent transition from one dominant form to the other and with an impact on the environment, which led to today's climate change. The industrial revolution witnessed tremendous exploitation of fossil-based energy resources with substantial emission of greenhouse gases. Energy security propels socio-economic development, however, achieving energy security towards sustainable development has been a huge challenge for Nigeria despite the substantial availability of renewable and non-renewable energy. This paper assesses the current status of energy utilization in Nigeria and the role of renewable energy towards mitigating the emission of greenhouse gases and achieving sustainable future for the country. Available (secondary) data shows a huge gap between the energy demand and the actual amount generated. The difference between the installed capacity and actual generation capacity indicates very low-capacity utilization. Whereas the percentage of renewable in the generation mix is equally very low. Analysis of greenhouse gas emission using RETScreen tool indicates that power generation from the generating companies of Nigeria produces 15,556,817 tCO_2, 22,475,102 tCO_2, and 28,807,085 tCO_2 when generated via natural gas, oil, and coal respectively. Available renewable energy resources and technologies could be deployed to sustainably bridge the demand gap if the noted challenges are adequately addressed.

Keywords: Greenhouse Gas; Sustainability; Renewable Energy Technology; Indoor Pollution; Energy Utilization

Introduction

Provision of clean sustainable energy, which is the 7th goal of the United Nations Sustainable Development, is interconnected with other goals and it plays a vital role in the socio-economic development of any country and its citizens, hence the continuous exploitation of energy resources (Menges and Pfaffenberger, 2015; Shoaib *et al.*, 2016). Indicators of socio-economic development and human development index (HDI) are not unconnected with the sustainably affordable energy supply. However, achievement of energy security is becoming a major challenge for most of the global communities in the recent times due to increase in energy demand resulting from increase in population. This is in addition to the complexity of the demand itself, and environmental issues surrounding the conventional sources of energy aside its finite nature of supply. This calls for exploitation of renewable energy to promote clean energy supply and aids the achievement of indicators of socio-economic development.

The global energy insecurity and the associated economic discomfort caused by energy crises between Arab countries and the Western World in the 1967 and 1973 necessitated increase in the search for alternative energy sources and energy management systems *(Daniel (Haqeem & Zulkifli, 2022; Nwaezeigwe, 2021)* by the affected countries. In addition to other measures such as fuel rationing, reduced driving habits, and establishment of Federal Energy Administration, the United States America announced the National Energy Plan for creating energy security for the future with focus on geothermal energy, wind energy, nuclear energy, and solar energy *(Krutakov, L 2021; Van e Graaf T. 2014; Daniel Haqeem & Noraini Zulkifi 2022).* In addition to ensuring less reliance on fossil-based energy that is mostly imported, European Energy Policy was formulated to increase the shear of renewable energy in the supply mix and to mitigate the environmental impacts of conventional energy sources *(Tang, 2012; Solangi et al., 2011)*. To promote utilization of renewable energy for improved energy security, each of the member states employs different incentivizing instruments such as feed-in tariffs, tax reduction and quotas among others *(Buchinger, Josef 2012; Roland Menges 2015).*

In the Asia region, renewable energy is however understood to be relatively capital intensive with low internal rate of return (IRR), hence provision of incentives such as tax exemptions and concession agreement between government and investors in order to improve the IRR and significantly reduce market risk *(Wang, Qiang 2010; Chua, Shing Chyi2012).* This was aimed at enhancing the utilization of indigenous renewable energy sources for national electricity supply security and sustainable

socio-economic development *(Chen, 2012)* and to improve the renewable energy proportion of the national power generation mix, enhance development of renewable energy industries as well as conserving the environment *(Solangi et al., 2011).* A major turning point in the development of renewable energy was the formation of the International Renewable Energy Agency (IRENA) in 2009 with 154 member countries and with the objective of mitigating climate change and increasing economic growth, creating employment, and guaranteeing clean energy security *(Harjanne & Korhonen, 2019).*

The vast availability of natural resources for development of renewable energy towards energy security and environmental sustainability in Africa is largely underutilized. However, considering its contribution to mitigation of climate change and socio-economic development, number of African countries have come up with policies targeted at overcoming the perceived challenges against the development of renewable energy sector (*Abubakar Kabir et al 2017; Bugaje 2006).* The energy commission of Nigeria (ECN) was established with the mandate to conduct research and development (R&D) on renewable energy technologies and to popularize its applications all over the country *(Ilenikhena and Ezemonye, 2010).* Various other government's efforts towards energy security and environmental sustainability include the National Energy Policy (2003), Renewable Energy Master Plan (2005), National Renewable Energy and Energy Efficiency Plan (NREEEP 2014), establishment of Rural Electrification Agency, Nigerian Electricity Regulatory Commission (NERC), and NASENI Solar Energy Limited among others,

The vast renewable energy potential as well as relevant institutional and policy frameworks place Nigeria in better position for optimal exploitation of renewable energy resources to improve its energy supply and bridge the gap. However; there is persistence of energy supply shortage and deployment of renewable energy technology has been significantly low as evident in Nigeria's low par capital energy consumption and HDI. More than 50% of the total population still lack access to power supply from the grid and are left with either off-grid or other means of meeting their daily energy needs. Other means of meeting the daily energy need mostly include burning of wood biomass that leads to high prevalence of indoor pollution and high rate of deforestation (Addo and Olajide 2021). Inadequate renewable energy infrastructure and its seemingly high investment cost had equally slowed down the penetration of its utilization and contribution to energy supply mix, with general effects on the socio-economic activities.

This paper therefore set out to assess the status of Nigeria energy security, analyze the role of renewable energy as a decentralized system, and potential contribution to reducing greenhouse gas emission and climate change effects. It is to further identify

the challenges of renewable energy towards contribution to the national energy mix and proffers appropriate recommendations

Conceptual Clarification

Energy security

Energy security has been conceptualized in many ways by different literatures and organizations. According to the Organization for Economic Co-operation and Development (OECD), energy security simply means "the availability of sufficient supply of energy at affordable prices". The international Energy Agency (IEA 2019) also conceptualizes energy security as "the uninterrupted availability of energy sources at an affordable price", while the World Energy Council (2008) defined energy security as "the availability of local and imported resources to meet the growing demand for energy over a period of time at affordable prices". Meaning that energy security can be achieved by combination of locally available and imported energy resources provided it meets the price affordability criteria and can be viewed in terms of short-term or long-term. While the short-term focuses on energy system to react promptly sudden interruption in energy supply, long-term focuses on timely investment on energy to guarantee its availability in line with economic reality and environmental need. And according to Aleh and Jessica 2014, a secured energy system must meet the four As, criteria as presented in Table 1

Table 1: Four As of Energy Security

As Criteria	Details
Availability	Ensures availability of energy supplies in sufficient amounts
Affordability	Ensures that energy resources are available at sufficiently-low prices
Accessibility	Ensure access to energy services by all citizens, through provision of reliable infrastructure to ensure a robust supply for the end users at all locations.
Acceptability	Ensures that energy supplies keep the negative impacts to the barest minimum to make the energy acceptable to the custodians. The negative impacts include pollution and environmental damage, and human health impairment

Anergy system acceptability ensures climate friendly energy supply and utilization and is directly related to environmental sustainability

Energy Utilization

According to Ayhan Demirbas *(2002),* demand for energy and its effects of on all aspects of life is at exponential increase due to population growth, hence, the need for

efficient use of energy through appropriate technologies to ensure sustainability of both energy and environment. Energy resources are used to provide services such as heat, cold, and light to power the economic activities through industrial process, transportation, and communication among others, hence the call for improvement in efficiency of energy utilization. Nigerian government sees the need to diversify its energy mix via exploitation of renewable sources such as solar, wind, hydro, biomass, and geothermal to provide secure energy, jobs and a sustainable and clean environment. National Renewable Energy and Energy Efficiency Plan (NREEEP) is an effort of Nigerian government targeted at; attaining the replacement of 40% by 2020 and 100% by 2030 of old and inefficient appliances in Nigeria with energy efficient ones. However, the public awareness of the tremendous renewable energy resource available for utilization still needs improvement.

Renewable Energy

Renewable energy refers to energy derived from naturally replenishing sources, which include; sunlight, wind, the movement of water, and geothermal heat. According to *(Marc et al., 2012),* renewable energy sources as seen as green, abundantly free, and with very little or no harmful effects on environment either from their usage or their process of production. Hence its importance in energy security and climate change mitigation. Renewable energy provides varieties of energy such as on-grid and off-grid electricity generation, air and water heating/cooling for various applications. It constitutes about 30% of global energy consumption with the projection of contributing more than 35% in 2025 (WEC 2023). With respect to the scope of this paper, the focus on renewable energy source with significant potentials in Nigeria.

Human Development

According to the UNDP, human development approach is about expanding the richness of human life, rather than only the richness of the economy in which human beings live. It is an approach that is focused on creating fair opportunities and choices for all people though: 1) directly enhancing human ability, and 2) creating conditions for human to develop. Human development and economic growth drive global energy demand *(Ramli et al 2015)*, hence the need for affordably sustainable energy supply to enhance both human development and economic growth. A considerable degree of correlation exists between energy use and indicators of human development such as; improvement of livelihoods, improved health and education outcomes, increased income through productive uses of energy, and human dignity *(Ruppel and Althusmann 2016)*. There is, however, a growing consensus on the vital role the utilization of renewable energy resources could play in meeting Nigeria's development challenges which include accelerating economic growth, reducing poverty, promoting

human development index (HDI), and addressing environmental concerns *(REMP 2012).*

Climate change

Climate change is referred to as a long-term change in the average weather conditions including changes in temperature, rainfall, sea-level, and windiness. According to (Treut *et al.*, 2007), climate change refers to the mean variability of temperature, precipitation and wind over a period of time, ranging from months to millions of years. UFCCC (2011) defined climate change as *"a change of climate which is attributed directly or indirectly to human (anthropogenic) activity, leading to alterations in the composition of the global atmosphere which is in addition to natural climate variability observed over comparable time periods".* The natural variability results from changes in the sun's activity or large-scale volcanic eruption. The anthropogenic induced variability is generally due to burning of fossil fuels such as coal, oil, and gas which are major cause of greenhouse gas emission into the atmosphere. Quest for more energy to drive industrialization and urbanization is largely responsible for greenhouse gas emission with consequent impact on the atmosphere including rise in earth surface temperature. According to United Nations, the average temperature of the earth surface is now about 1.1^0C warmer than it was in the late 1800s before the industrial revolution, and warmer than any time in the last 100,000 years. The effects of climate change are felt in different ways including health, food production, heat waves, housing, and safety (on transport, at home and at work), with different severity of vulnerability especially among the people living in flood prone areas of developing countries such as along River Niger in Nigeria. Issues relating to climate change form one of the major reasons for increasing global support and adoption of renewable energy to achieve energy security.

Methodology

The study adopts mixed method approach in the data collection and analysis but rely mainly on secondary data obtained from reliable sources from scholarly published journals, government reports and policy documents, industrial data, as well as reports from national, regional and international organizations working on energy security and climate change. Qualitative data were used to strengthen arguments on the analysis of the quantitative data to arrive at evidence based and logically sound deductions on Nigeria status on energy security and climate change preparedness.

Energy Utilization and Greenhouse Gas Emission in Nigeria

There exists abundance of renewable and non-renewable energy sources in Nigeria out of which non-renewable is mostly explored apart from biomass. Meanwhile the biomass is mostly used in its unprocessed form in Nigeria (Fig 1).

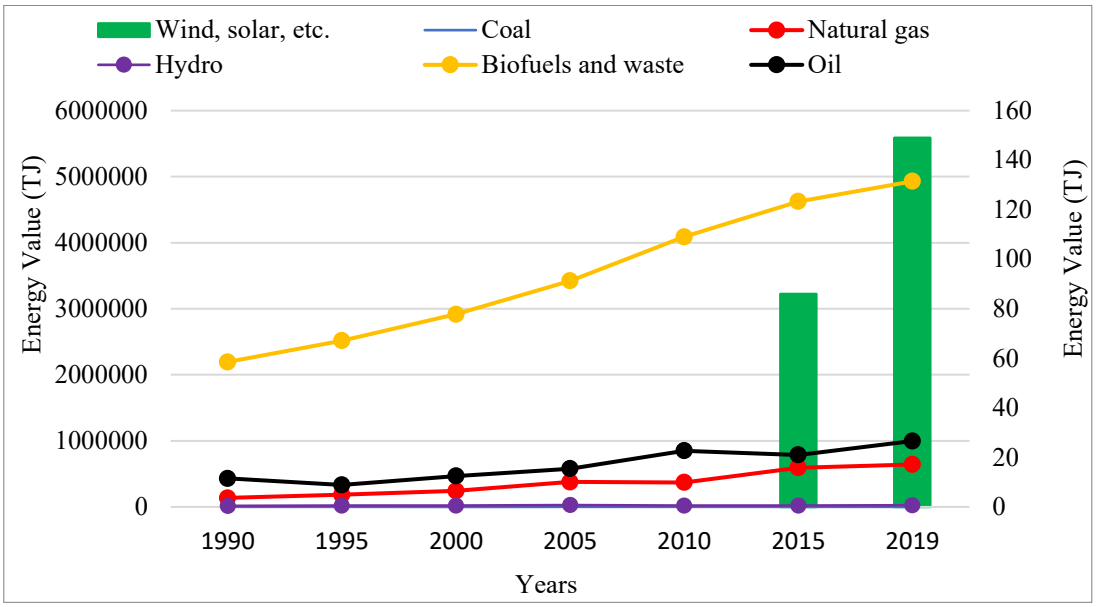


Figure 1: Nigeria total energy supply by source 1990-2019 (Data source: IEA 2022)

With a population of approximately 220 million, Nigeria total electricity generating capacity averages between 4000 and 5000 MW out of over 11,000 installed capacity. This indicates very low-capacity utilization, even though the total installed capacity which translates to 150 kW-h electricity consumption pa capita is below the acceptable minimum for Sub-Saharan Africa (180 kW-h). Considering the rule of thumb by Vencent and Yusuf (2014), cited by (Eweka *et al.*, 2022), 1,000,000 people require 1000 MW, implying that 220,000,000 Nigerians require an average of 220,000MW. For instance, South Africa with a population of 57.78 million generates 58,096MW of electricity with a total electricity access of 95% urban and 92% rural areas (USAID/Power Africa 2023). Meanwhile, about 65 % of the power was generated via thermal plants that make use of fossil fuels. This, and the burning of crude biomass for domestic and commercial energy needs are a major source of greenhouse gas emission in Nigeria. Crude burning of wood biomass by 70% of the population in Nigeria to meet-up their daily anergy need is due to poor access to modern energy services (Okafor *et al.*, 2022). This however has led to high prevalence of indoor pollution with more impacts on the vulnerable groups, and lack of carbon sinking due high rate of deforestation.

Table 2: Breakdown of National Power Generation

STATION	TURBINE	AT PEAK	OFF PEAK
Kainji	Hydro	424.0	363.00
Jebba	Hydro	451.0	371.00

Shiroro	Hydro	600.0	486.00
Dadin Kowa	Hydro	36.0	36.20
Egbin	Steam	545.0	400.00
Sapele	Steam	38.0	0.00
Delta	Gas	358.0	356.00
Afam Iv-V	Gas	0.0	80.00
Omotosho Gas	Gas	93.1	91.50
Olorunsogo Gas	Gas	102.3	101.70
Geregu NIPP	Gas	101.0	102.00
Alaoji NIPP	Gas	110.4	83.50
Omotosho NIPP	Gas	108.0	100.90
Odukpani NIPP	Gas	326.7	294.90
Okpai	Gas/Steam	425.0	401.00
Azura - Edo IPP	Gas	440.0	384.00
Ibom	Gas	25.2	25.50
Omoku	Gas	51.0	46.20
Trans Amadi	Gas	48.7	35.80
Rivers IPP	Gas	120.0	80.00
Paras Energy	Gas	47.7	45.60
Total		**4,451.1**	**3,884.8**

Source: TCN 2022

Current energy utilization and climate change

From the largely untapped renewable energy resources, Nigeria's Renewable Energy Master Plan (REMP) was developed to optimally harness the potential. Through the plan, Nigeria aims to increase the proportion of renewables in the nation's electricity supply by 13%, 23%, and 36% in the year 2015, 2025, and 2030 respectively. The plan targets energy security through renewable energy sources and clean energy technologies (Ezealigo, Otoijamun and Onwualu, 2021), thereby reducing greenhouse gas emission (Nwozor *et al.*, 2021). Achieving this would probably propel Nigeria electricity coverage to about 80% general coverage but requires expending an estimated ₦ 4 billion, ₦ 178 billion, and ₦ 610 billion respectively for short-term (2005 – 2007), medium-term (2008 – 2015), and long-term (2016 – 2025). This has however remained a major challenge as renewable energy contribution into the national energy mix remains insignificant (2.16 MW) and energy insecurity persists (Statista 2023). The Nigerian Energy Transition Plan (NTP) 2022 is also a toll for Nigeria to achieving carbon neutrality by electricity generating capacity via decentralized renewable energy (solar) system and ramping-up gas generation prior to 2030 to facilitate renewable energy development among others. The NTP is however

managed by energy transition working group with little involvement/awareness of other relevant stakeholders including the non-state actors.

As indicated in Table 2, about 66 % (2940MW) of Nigeria total current electricity generation is powered by fossil fuel. The emission analysis of the power generation using natural gas, coal, and oil is as presented in Table 2. The analysis is carried out using RETScreen tool that has been deployed in similar studies (Pan *et al.*, 2017; Samuel, 2020). It is a feasibility analysis tool for energy project that compares a base case (using fossil fuel) and a proposed case (using renewable source) to determine project feasibility in terms of financial viability, emission analysis, and cost-to-benefit ratio (Moya, Paredes and Kaparaju, 2018).

Table 2: Emission analysis of current power generation using RETScreen

1. Fuel type - NATURAL GAS		**GHG emission factor - 0.502 tCO_2/MWh**		
Base case system GHG summary (Baseline)				
Fuel type	**Fuel mix (%)**	**Fuel consumption (MWh)**	**GHG emission factor (tCO_2/MWh)**	**GHG emission (tCO_2)**
Electricity	100.0%	30,975,360	0.502	15,556,817.0
Total	100.0%	30,975,360	0.502	15,556,817.0
GHG emission reduction summary				
Power project	**Base case GHG emission (tCO_2)**	**Gross annual GHG emission reduction (tCO_2)**	**GHG credits transaction fee (%)**	**Net annual GHG emission reduction (tCO_2)**
	15,556,817.0	15,556,817.0	0.00	15,556,817.0
Net annual GHG emission reduction	**15,556,817 tCO_2 (equivalent to 36,178,644 Barrels of oil not consumed)**			
2. Fuel type – OIL (#6)		**GHG emission factor –** 0.726 tCO2/MWh		
Base case system GHG summary (Baseline)				
Fuel type	**Fuel mix (%)**	**Fuel consumption (MWh)**	**GHG emission factor (tCO_2/MWh)**	**GHG emission (tCO_2)**
Electricity	100.0%	30,975,360	0.726	22,475,101.7
Total	100.0%	30,975,360	0.726	22,475,101.7
GHG emission reduction summary				

Power project	Base case GHG emission (tCO_2)	Gross annual GHG emission reduction (tCO_2)	GHG credits transaction fee (%)	Net annual GHG emission reduction (tCO_2)
	22,475,101.7	22,475,101.7	0.0	22,475,101.7
Net annual GHG emission reduction	22,475,102 tCO_2 (equivalent to 52,267,679 Barrels of oil not consumed)			

3. Fuel type – COAL		GHG emission factor – 0.93 tCO_2/MWh		
Base case system GHG summary (Baseline)				
Fuel type	Fuel mix (%)	Fuel consumption (MWh)	GHG emission factor (tCO_2/MWh)	GHG emission (tCO_2)
Electricity	100.0%	30,975,360	0.930	28,807,084.8
Total	100.0%	30,975,360	0.930	28,807,084.8
GHG emission reduction summary				
Power project -1	Base case GHG emission (tCO_2)	Gross annual GHG emission reduction (tCO_2)	GHG credits transaction fee (%)	Net annual GHG emission reduction (tCO_2)
	28,807,084.8	28,807,084.8	0.0	28,807,084.8
Net annual GHG emission reduction	28,807,085 tCO_2 (equivalent to 66,993,221 Barrels of crude oil not consumed)			

From Table 2, it is evident that only 34% of the current power generation is climate-friendly while the remaining 66% generated from fossil-based produces different quantities of greenhouse gas emission depending of the fuel type. Power generated from natural gas produces GHG emission of 15,556,817 tCO_2 which can also be quantified in terms as 36,178,644 barrels of oil not consumed, while the one generated from oil produces emission of 22,475,102 tCO_2, equivalent to 52,267,679 barrels of oil not consumed. Similarly, when the same amount of power is generated from coal, it produces 28,807,085 tCO_2 emission which is equivalent to 66,993,221 barrels of crude oil not consumed. Apart from their non-renewable nature, these energy sources present huge climate challenges and substituting them with renewable energy will not only preserve the environment but also the energy sources itself

Renewable Energy Potentials

Renewable energy offers a wide variety of application potentials as shown in Figure 3. Nigeria has relative advantage of better availability potential

Table 3: Nigeria's renewable energy resources and application potentials

RE Source	Technology	Output	Potential	Ref
Solar	Solar Thermal; Solar PV	Concentrated Solar Power; Sorption cooling systems; Solar driers; Domestic hot water; Process heating systems; Lightings; Light electrical load	3.5 – 7.0 kW-h/m^2 per day Up to 5 MW of solar Feed-in Tariff It could generate 1850×103GWh electricity per year Solar hot water can save energy equivalent to 50-80 percent of residential and industrial hot water bills	(Shaaban and Petinrin, 2014) *(Sambo, 2009)* *(Azhar et al 2021)*
Hydro	Mini/small hydro	Electricity	Available up to 3,500 MW Home developed prototype turbine has been developed by NASENI It has the potential to serve host communities	ECN 2022; *(Fagbohun 2016)*
Ocean	OTEC	Electricity; District cooling; Aquaculture; Other spin off activities	Preliminary studies indicate Nigeria's potential for 10 Nos of **multi-product OTEC plants** each generating **100-500MW**, along the coastal shores of the country on incremental basis OTEC Plant deliverables include Hydrogen for Hydrogen Fuel cells and Jet Fuel; Ammonia for fertilizer; Portable water-about **10 million** liters per day per for every **100MW** of the plant; Edible and Industrial Salts; District cooling/refrigeration; and Agriculture	Herrera, Jorge et al 2022; Herrera, Jorge 2022; *(NIOMR, 2023)*
Bio – energy	Solid biomass/ Bio fuels	Electricity; Process heat; Liquid and gaseous fuels	Wood forest of 13,071,464 ha Crop residue of 18 million tons per year Animal waste of 61 million tons per year	Nwozor et al 2021; Ezealigo 2021; REMP 2005

	Emergence of clean biomass technology

In addition to the technical and feasibility potential, global weighted average for installation cost, capacity factor and levelized Cost of RE technologies also indicated that improved performance of renewable energy which Nigeria can leverage to achieve responsible energy security as shown in Table 3

Table 4: Financial Feasibility of Renewable energy

R.E Technology	Total Installed costs (USD/kW)			Capacity factor (%)			Levelized cost (USD/kWh)		
	2010	2021	Change	2010	2021	Change	2010	2021	Change
Bioenergy	2,714	2,353	-13 %	72	68	-6 %	0.078	0.067	-14 %
Hydropower	1,315	2,135	62 %	44	45	2 %	0.039	0.048	24 %
Solar PV	4,808	857	-82 %	14	17	25 %	0.417	0.048	-88 %
CSP	9,422	9,091	-4 %	30	80	167 %	0.358	0.114	-68 %
OTEC	5,000	1,240	-75 %	90	95	5.6 %	0.180	0.029	-84%

Source: *(IRENA 2022, IRENA 2012; Jessica et al 2022; Kumar C.M 2023)*

Renewable Energy Utilization Challenges

Technical barriers

Lack of skilled personnel, lack of code for standard, lack of maintenance and operation, lack of training facilities and entrepreneur's development: (the barriers lead to poor plans, poor standard, constraints of the competitive market, inadequate knowledge to know about risk acceptance. All these barriers resulted in technology locked-up. Although some of renewable energy technologies have reached full maturity, there is need for further research and development for their adaptation and adoption to suit the local environment for ease of maintenance and operation.

Socio-cultural behaviour

Lack of consumers awareness about the product, lack of understanding of benefits of renewable energy, and public resistance to change. For instance, the resistance to change to new technology such as energy efficient appliances and energy efficiency practices. The poor awareness of the benefits of renewable energy affects its demand giving rise to the still prevalence of crude burning of biomass for lighting in most of the rural communities.

Economic/ Financial

Renewable energy project is mostly characterized by high initial cost and low internal rate of return (IRR) unless it is incentivized. Lack of efficient incentive mechanism on renewable energy and energy efficiency measures, poor research and development supports poses a major challenge in Nigeria. Furthermore, lack of incentive for renewable energy entrepreneur and local manufacturers and startups (Emodi, Yusuf and Boo, 2014) presents challenges against renewable energy utilization and building of resilient environment.

Institutional/Regulatory/ Legal

Evidence-based policy with actionable implementation strategies, and well-suited institutional framework provides effective and successful implementation of such policy. Thanks to the signing of the Electricity Act 2023 which gives opportunities for decentralization of energy generation and transmission mostly from the renewable sources, Nigeria electricity constitutional provision in the past made it difficult for sub-national government and private sectors to invest in renewable energy (Emodi and Ebele, 2016). The absence of lead agency on renewable energy with clearly defined roles and responsibility is equally a challenge. This has led to virtually all science and technology related agencies working on renewable energy but in silos lead agency.

Political

Presently, the competitiveness of investment in renewable energy is still low due to high initial cost and low IRR unless it is considered over a long time (levelized cost). Considering the levelized cost of renewable energy requires stable and consistent policy to guarantee investors interests. Despite numerous renewable energy related policy and institutional frameworks in Nigeria, the lack of political will for their implementation presents a serious challenge against the utilization of renewable energy in Nigeria.

Conclusion and Recommendations

Nigeria is no doubt facing energy supply deficit and its associated poor human development caused by the use of climate unfriendly energy resources. This is primarily due to the country's inability to optimally harness its abundant renewable energy resources. There are quite a number of resources, technology, and framework for converting the huge renewable energy potentials into usable form and improve the energy supply and the livelihood of Nigerians. Utilization of renewable energy, though requires high initial cost, but better levelized cost and long-time advantages over the conventional types. There are a number of challenges against Nigeria renewable energy utilization, however, strong political will could help in overcoming most of the challenges.

Recommendations

- Federal government of Nigeria through relevant agencies to invest in capacity development in the form of increased research and development, and technical and vocational training tailored towards renewable energy utilization and development of its infrastructure.
- Currently existing energy and renewable energy policies and plans contain required financial reliefs that if well implemented could encourage renewable energy players and improve its share of contribution to energy mix while aiding the socio-economics and human development index through increases par capital energy consumption in Nigeria.
- Strong and purposeful political will from the government will help in the implementation of existing policies and plans, establishing good synergy among renewable energy related agencies, ensuring beneficial legal framework between national and sub-nationals on energy matter, and popularizing the awareness of the renewable energy across the socio-cultural boundaries in Nigeria

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