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## Sustainable Renewable Energy the Way Forward for New Nigeria

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### Abstract

It is factual that energy is essential for the economic growth of any given nation. Alternatively, biofuel technologies seem to be a potential replacement for non-renewable energy source but a huge problem is faced by many nations in terms of how to get a clean, dependable, low-cost and modern of energy to achieving long-term growth of sustainable environment. Nigeria's main energy source is non-renewable energy but there have a lot of problems associated with it, be it the carbon emission, the pollutions on the land and sea where this gas are extracted and refined and the prediction of sustainability of those non-renewable energy like fossil fuel. This review paper checks on alternative renewable energy source, the potentials it has in terms of developing a nation, the barriers in obtaining the energy and the workability in a nation. The accessibility and workability of alternative energy will result in a healthier community, decreases in the cost of goods and services, along with a decrease in air pollution, give poorer homes access to energy and affordability of energy bills and offset the price on buying fossil fuel product. Unquestionably, Nigeria is endowed with a wide variety of renewable energy resources., investing and maximize of such energy will help the nations socio-economic improvement. Renewal energy has to be top of the nation's priority and a strategic way to enhance it developed.

**Keywords:** Energy, sustainability, and renewable energy.

### Introduction

Renewable energy is defined as energy stemming from current resources that sustains itself by nature or replenish itself over time. It can be a far more long-term answer than our present top energy sources (Eseosa et al., 2020). In recent decades, the change in climate or the pollution of the environment has been a matter of concern worldwide, the activities of humans and variability of nature have been blamed for the changes (Adeyanju et al., 2020). According to the European union (EU); Increased usage of renewable energy is critical for national and global sustainability. Renewable energy sources could give crucial new approaches to lower pollution, diversify and grantee energy supplies, and help provide energy access to people in poverty. The burning of fossil fuels is the main source of greenhouse gas emissions, which must be lowered to alleviate the negative consequences of climate change and accomplish the eventual goal of the United Nations scheme convocation on Climate Change, preventing catastrophic climate change is the goal. In accordance to world energy outlook, admitting if every of the declared pledges were to be completely done on time, globe warming would have reached 2.1 degrees Celsius by the end of the century, meaning it is falling short of the Paris Agreement targets and raising climate risks significantly. The countries with the highest scores have the finest policies and initiatives in place to safeguard the environment, particularly natural resources, and reduce GHG emissions (Dogan et al., 2022).in central America, Countries require "loud, long, and legal" policies and methods to develop their renewable energy resources, including effective targets, concrete regulations, and working governance and administrative systems (Dolezal et al.,2013). Nigeria is the continent's energy powerhouse; Africa is said to be the continent with the highest production of oil. The crude oil reserve in Nigeria is rate sixth in the world, the nation is said to possibly be enrich with sustainable energy resource that is untapped (Oyedepo & Olayinka, 2012).

Over the last 40 years, the worldwide wildlife population has decreased by 60%, placing a million different species at risk of being extinct, highlighting the requirement to increase the quantity and size of protected areas. This was reflected in the EU's biodiversity strategy for 2030, which calls on the EU to expand its network of preserved areas to encompass 30% of Europe's land and sea, expand current networks, and ensure that areas with very high biodiversity and climate significance are rigorously protected. (Doukas et al., 2020). The issues of rising energy demand and pollution necessitate energy resource policies and governance. A systematic shift to more efficient energy regimes necessitates a carefully planned series of initiatives involving policymakers at all levels, from local to global. The key to facilitating adequate private finance flowing into clean energy investment is how policy frameworks are constructed. Understanding how to build successful frameworks for clean energy investment and the associated risk-return is critical (Lu et al., 2020). Governments, intergovernmental organizations, interested parties, and individuals worldwide are looking forward to achieving a sustainable future because of the convenience created in recent years to replace petroleum-derived materials from fossil fuel-based energy sources with alternatives in renewable energy sources. (Owusu et al., 2016). The goal of the study is to look at alternative and potential renewable energy sources for climate change mitigation, as well as the

extent to which they can help and the challenges they may pose, and how switching from non-renewable to renewable energy sources is a sure way to mitigate climate change.

### Methodology

The research method for this report involved reading relevant literature (journals, articles, and papers) on the impact of COVID-19 on construction management. Information from peer-reviewed books, journals, and reports was compiled via Web of Science SM, WHO, PubMed, Google, Google scholar, and document reference lists.

### Results and Discussions

#### Overall sources of energy resource in Nigeria

Globally For the year 2019, 84.32 percent of all energy was consumed using fossil fuels (Li et al., 2020). In addition to fossil resources like crude oil, natural gas, and coal, Nigeria is a wealthy country with access to renewable energy sources including solar, wind, hydro, and biomass., etc. Fossil fuels provide for the vast majority of the country's energy supply in Nigeria. (Akorede et al., 2017). The earliest commercial fuel is coal, which was produced in Nigeria in 1916 in quantities of 24000 tons. Prior to decreasing to the current minimal level, production reached a high point of almost to one million tons in 1959 (Osueke et al., 2011).

**Table 1:** Nigeria energy resources.

Resource	Reserves (natural units)	Production level (natural units)	Utilisation (natural units)
Crude oil	36.22 billion barrels	2.06 million bpd	445,000 bpd
Natural gas	187 trillion SCF	7.1 billion SCF/day	3.4 billion SCF/day
Coal and lignite	2.734 billion tonnes	insignificant	insignificant
Tar sands	31 billion barrels of oil equivalent	0	0
Large hydropower	11,250 MW	1,938 MW (167.4 million MWh/day)	167.4 million MWh/day
Small hydropower	3,500 MW	30 MW (2.6 million MWh/day)	2.6 million MWh/day
Solar radiation	3.5 – 7.0 kWh/m <sup>2</sup> /day	excess of 240 kWp of solar PV or 0.01 million MWh/day	excess of 0.01 million MWh/day solar PV
Wind	2 – 9 m/s at 10 m height	-	-
Fuelwood	11 million hectares of forest and woodland	0.12 million tonnes/day	0.12 million tonnes/day
Animal waste	245 million assorted animals in 2001	0.781 million tonnes of waste/day in 2001	not available
Biomass	72 million hectares of agric. land and all waste lands	excess of 0.256 million tonnes of assorted crops residues/ day in 1996	not available

\* SCF – standard cubic feet \* bpd – barrel per day

Source: (Akorede et al., 2017).

Nigeria is a country with a variety of energy resources; however, it is particularly abundant in natural gas and crude oil. Since the 1970s, oil has become a key component of Nigeria's economy, generating 85% of government revenue and nearly 98 percent of export earnings. However, the economy's excessive reliance on oil has made it very susceptible to outside factors (Abam et al., 2014).

#### Renewable energy development

The use of renewable energy has become a practical solution for both the energy crisis and environmental problems. (Li et al., 2020). Energy systems have the ability to significantly impact the environment in both developed and developing nations. Because of the current reliance on conventional fossil fuels, which are mostly generated in politically unstable nations, the energy supply and

consumption are utterly unsustainable. To satisfy today's and tomorrow's expectations for better living conditions (Salvarli et al., 2020). Using renewable energy sources and ensuring that citizens have access to reasonably priced, dependable, sustainable, and modern energy are two ways to accomplish sustainable development. (Majid & M.A., 2020). Globally, the use of renewable energy climbed by 5.62 percent annually in 2017, which was 2.95 times higher than the growth of primary energy consumption. (Li et al., 2020). In particular when it comes to biodiversity and ecosystems, as well as community involvement in decision-making, the growing use of strategic estimates for renewable energy policies, plans, and programs should be supported by better data. Renewable energy projects, particularly those of greater scale and size, have been subjected to impact assessment methodologies (Athanas et al., 2013). The benefits gotten from renewable energy extended beyond ensuring a reliable and long-term energy supply. Renewable energy has the potential to significantly contribute to employment development. The usage of renewable energy in Europe has resulted in the creation of over 500 000 employment and the avoidance of around 110 million tons of greenhouse gas emissions. Technologies from renewable energy have matured to the point where they can be deployed on a massive scale. Renewables have been demonstrated to be reliable, and a mix of renewable energies is constantly available. It will take time for a totally sustainable energy future to emerge. Existing utilities and other fossil and nuclear energy benefactors will not simply leave; they will fight to maintain their market share and halt the distribution of renewable energy (Hinrichs-Rahlwes & Rainer, 2013). Renewable energy technology could allow countries with abundant solar or wind resources to use these sources to supply domestic demand. Furthermore, renewable energy technology may allow these countries to use renewable energy sources that have long-term export potential (Abolhosseini et al., 2014). Renewable energy requires markets that are open to it. New players, renewable technologies often find it challenging to gain access to energy markets. Barriers on a variety of levels can turn investing enthusiasm into despair. Externalities from incumbent energy sources, such as fossil and nuclear, are not internalized, resulting in damaging subsidies to these technologies around the world, necessitating strong and long-term regulatory frameworks for renewables (Fouquet & Dörte, 2013).

### **Need for clean energy**

in developing nations, where significant energy generation is required to meet the demand for sustaining industrial and economic expansion. Increasing pressure on environmental impact to reduce emissions to the atmosphere is made more difficult when the factors of high population density, energy poverty, and a sizable number of lower-middle and middle-income people are combined. With the least possible negative effects on the environment and the greatest possible resource extraction, renewable energy is the answer to the world's energy needs (Pathak & Pankaj, 2020). Burning fossil fuels is a major contributor to both air pollution and climate change. CO<sub>2</sub>, one of the primary greenhouse gases causing climate change, is a significant byproduct of the production of electricity. Air contaminants that are bad for your health are also commonly produced by electricity. 31 000 more deaths in the US in 2010 were

brought on by emissions from energy production. One of several techniques that can lessen dependency on fossil fuels, decrease greenhouse gas emissions, and lessen the burden on human health and other environmental effects associated with power generation is the deployment of renewable energy sources (Buonocore et al., 2019). Energy that is produced with as little negative influence on the environment as possible is referred to as green energy. It is a sustainable form of energy. Green energy sources including solar, wind, geothermal, and hydropower are being developed and marketed as alternatives to fossil fuels that contribute little to no to climate change. The benefits of this green energy are as follows; It is a clean form of energy that has no impact on the environment or human health because it does not emit any hazardous gases as a byproduct. The majority of them have domestic sources, enabling any state to manufacture its own energy without relying on foreign fuel supplies. It does not generate air pollution; for instance, wind turbines do not emit substances that contribute to acid rain or global warming. By harnessing geothermal energy, Future generations won't be unable to use their current resources in the same ways if current generations don't put them in danger (Kalyani et al., 2015). According to research, sustainability can be achieved by gradually switching from fossil fuel-based energy sources to renewable energy sources (Owusu et al., 2016).

### **Hydropower**

According to studies, Before the discovery of crude oil, the only source of electricity in Nigeria was hydropower. The decline in the advancement of the hydropower sector was brought on by the deviation in focus toward fossil fuels as a result of the country's enormous fossil fuel reserve. Nigeria is significantly dependent on fossil fuels for the generation of electricity due to its vast supplies of natural gas and crude oil. Nigeria produces less than 4000MW of energy, and its per-person consumption is only 0.03KW, despite its massive crude oil reserves (Oparaku, 2007). According to study, Nigeria has only utilized about 13% of its hydropower potential (Ohunakin et al., 2011). It has been demonstrated that the twelve states' small hydropower potentials might be fully utilized to increase the number of accessible megawatts by more than 20 percent while also enhancing the energy mix. Small hydropower development should be the arrowhead of a dynamic renewable energy policy that is implemented in order to be able to do this (Igweonu et al., 2012). Some of the benefits of hydropower according to a study, without affecting the amount of water, Using the power of moving water, hydroelectricity creates energy. fit the idea of sustainable energy. When compared to alternative kinds, using hydroelectric power plants with reservoir accumulation offers operational flexibility. Hydroelectric power plants are more effective and cost-effective in supporting the usage of sporadic renewable energy sources because to their flexibility and storage capacity. River water is an abundant natural resource that may be used for home purposes, unlike fuel or natural gas. The efficiency, adaptability, and dependability of this one and only significant renewable source of electricity contribute to maximizing the use of thermal power plants. More quickly than any other energy source, hydroelectric facilities may pump energy into the electrical grid. During the hydropower life cycle, very little greenhouse gas

emissions occur. There are no air pollutants released by hydroelectric power facilities. Hydroelectric plants, which supply communities with energy, roads, industry, and trade, allow the growth of the economy, enhanced access to healthcare and education, and improved quality of life. Over a century of research and development have gone into the technology of hydroelectricity. Because they typically endure 50 to 100 years, hydroelectric improvements are long-term investments that can benefit multiple generations. They have very cheap operating and maintenance expenses and are easily modified to integrate more modern technologies (Fakinde et al., 2019). Nigeria's geography is good, with lowlands close to the coast and in the lower Niger valley, high plateaus and mountains in the north and along the eastern border, and heights ranging from 600 m to 2042 m. The majority of rivers and dams have favorable elevations for a variety of small hydropower uses (Ohunakin et al., 2011). The main drawbacks of hydropower are its negative effects and relatively costly initial capital expenses. building projects are based on indigenous species' living conditions (Akcin et al., 2015).

### **Solar Energy**

In the near future, solar energy will be crucial to finding a solution to the energy dilemma. Solar energy, which depends on the sun's lifespan, is dependable, limitless, and cost-free (Akcin et al., 2015). Due to its tropical location, Nigeria is subjected to an excessive amount of sun radiation. The country of Nigeria receives an average of 6.25 hours of sunshine per day, ranging from 9.0 hours in the far north to roughly 3.5 hours in the coastal regions. The average daily solar radiation received by Nigeria ranges from about 12.6 MJ/m<sup>2</sup> at the southern coastal latitudes to about 25.2 MJ/m<sup>2</sup> per day in the far north, giving the country's average 18.9 MJ/m<sup>2</sup> per day. This translates into a power density of 229.1667 W/m<sup>2</sup> (Chanchangi et al., 2022). According to estimates by the Nigerian Energy Commission's Director-General 2019 report, 1% of Nigeria's geographical surface might be covered with solar panels with a 5% efficiency, which would allow for the production of 333,480 MW of power at a capacity factor of roughly 26%. According to solar report Nigeria commissioned by the Netherlands enterprise agency, many are now aiming for Nigeria for solar energy, which may be attributed to the country's prodigious sunshine as well as its persistent lack of electricity. One of the markets for solar energy that is reportedly expanding the quickest is Nigeria. According to calculations made by the Heinrich Boll Stiftung, Nigeria's off-grid industry for mini-grids and solar household systems is expected to generate \$10 billion in income yearly and save the country's residents and businesses \$6 billion. Solar energy is a good prospective option for producing clean electricity because it is unrenewable and pollutant-free. By making investments in solar energy technologies, we can help end energy poverty in the third world nations and reduce greenhouse gas emissions (Chanchangi et al., 2022). Solar energy is an endless supply of sustainable energy, and the generation of photovoltaic solar energy is regarded as clean energy, when combined with other renewable energy sources, solar energy offers significant advantages as a sustainable energy source. It also enables meeting remote locations' electrical demand without the requirement for

grid connectivity (Novas et al., 2021). One of the most affordable, clean energy sources is solar energy. For residential, commercial, and industrial facilities, it is used to supply cooling, hot water, power, and even heating. In terms of energy sources, solar power is seen as dependable, promising, and profitable. Numerous benefits exist for it, including a long lifespan and minimal upkeep. Our daily lives involve a variety of uses for solar energy (Choifin et al., 2021). According to a study, using solar energy will result in a 10% reduction in greenhouse gas emissions and air pollutants over the course of 30 years, with benefits to the environment and public health totaling between \$77 and \$298 billion and \$56 to \$789 billion, respectively. Additionally, solar energy has been shown to cut water withdrawals and consumption by 4% and 9%, respectively, in many states that are prone to drought and those that are desert (Larsen & Peter H, 2019). According to a study, solar energy can successfully replace fossil fuel facilities, particularly those that burn coal and natural gas. Daily admissions for cardiovascular and respiratory illnesses, especially those involving the upper airways, are decreased by solar power plant operations. that investments in power generation capacity for these clean resources might increase societal benefits by bringing about favorable health results in impoverished countries. (Rivera et al., 2021).

### **Wind Energy**

By whirling its blades, Wind turbines convert the wind's kinetic energy into electrical energy. (Herbert et al., 2007). According to study, when a generator is connected to the primary shaft, the power of the wind is utilized to change the propeller blades surrounding the rotor into a generator that can create electricity, In the combined pumped storage facility, wind energy is taken into account as a way to reduce energy fuel by spinning wind turbines and injecting it into the electrical grid (Lund & Henrik, 2007). The need to produce power sustainably, preferably using wind energy, is being driven by rising energy demand and diminishing fuel resources. Wind energy, which is the most affordable and one of the energy sources with the quickest rate of growth in the world, is widely acknowledged as one of the clean and renewable methods of energy harvesting (Akcin et al., 2015). Comparing wind energy to other renewable energy sources, it has been proven to be clean, environmentally benign, and less expensive. The earth will be shielded from atmospheric pollution thanks to this energy source. In comparison to energy production facilities using fossil fuels, it was also discovered that using wind energy can minimize water consumption. Additionally, it was discovered that compared to other energy sources, wind energy had the fewest environmental effects (Saidur et al., 2011).

### **Conclusion**

It is clear that as Nigeria's population grows, so do its energy needs, but with less supply of energy still being an issue and the domination of the primary source of energy is fossil fuel. Although the nation's abundant renewable energy resources and vast potential are generally known, the fundamental problem is the country's inefficient use of energy. The renewable energy has to tapped in fully for a new Nigeria to enjoy proper and environmental safely energy. This review studies show how hydropower has

been a source of energy in Nigeria before focus was turned to fossil fuel reserve, it points the effectiveness of hydropower in terms of economics and environmental. The studies show the abundant supply of sunlight light in the northern part of the country and how that can be utilized and lastly the present of wind energy and its potentials. An efficient, dependable, decentralized, and economy-wide energy system built on a clean energy source is necessary to establish an energy system that is sustainable.

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