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RENEWABLE ENERGY: A PANACEA TO MITIGATING THE HARSH EFFECTS OF CLIMATE CHANGE

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10.5281/zenodo.21450451**Abstract**

The creation of our current environmental awareness stems from man's technical achievements in harnessing the power of nature for his own ends. Climate change demands that nation states increase their renewable energy capacity and, in so doing, become less dependent on fossil fuel energy. Nation states must also endeavour to reduce their energy footprint and improve their energy productivity. This will require the construction of substantially more small and large-scale renewable energy infrastructure and the implementation of effective energy efficiency measures. Renewable energy can be defined as energy obtained from energy sources whose utilisation does not result in the depletion of the earth's resources. Renewable energy also includes energy sources and technologies that have minimal environmental impact, such as less intrusive hydro's and certain biomass combustion. This study examines how renewable energy can be applied towards the amelioration of the harsh effects of climate change. The doctrinal method of legal research was adopted in this study and primary and secondary sources such as cases, legislation, textbooks, journals and various electronic sources were consulted. The study finds that the capacity of the ecosystem to sustain life is being threatened by man's energy related activities. It is therefore recommended that positioning Nigerian energy laws, policies, and regulations to encourage the use of renewable resources for energy production is essential for ensuring environmental sustainability. The research concludes that the sustainability of the use of renewable energy in Nigeria will rely on the political will of the government to initiate and implement laws to enhance the development of renewable energy sources.

Keywords: Environment, climate change, renewable energy, fossil fuels, sustainability, greenhouse gases

I. Introduction

In recent years, the close link between energy use and supply and anthropogenic emissions of greenhouse gases, and carbon dioxide in particular, has driven strong efforts to mitigate emissions through both energy efficiency and low carbon supply technologies. Even more recently concerns about the security of energy supply have also risen to the surface, prompting much debate and underpinning a variety of strategic developments. One of the current global

trends in the energy sector is promoting the integration of renewable energy in the energy mix; this trend has been mainly driven by the need for development, energy security, and climate change concerns.¹

As world population increases, so does the demand for energy for homes, businesses, and industrial use. Climate change has continued to be a major challenge to sustainable development because of the inter relationship between climate change and industrialization. Human activities in urban and industrial areas, where the predominant power source is fossil fuels (non-renewable energy), are usually in the form of natural gas, coal, and oil.² The current energy trend in the globe is to move away from a carbon regime. In order to achieve this, stakeholders are developing renewable energy technologies, and the regulatory framework within which these technologies will operate. Renewable resources are natural resources which have the ability to regenerate after use.

Mankind had used renewable energy, especially from the sun, for centuries before it attracted organized global recognition.³ RE did not receive this recognition until the global community called for the balance between development and environment in the decades following World War II. Nonetheless, there are still challenges on how to realize Sustainable Development (SD) beyond the precincts of principle. Although the most eminent driver of development is arguably energy, pollution from energy activities is the highest cause of environmental problems.

2. What is Renewable energy?

Renewable energy is energy derived from natural sources that are replenished at a higher rate than they are consumed. Sunlight and wind, for example, are such sources that are constantly being replenished. Renewable energy sources are plentiful and all around us.⁴

¹ Adrian Bradbrook, “The Development of Renewable Energy Technology and Energy Efficiency Measures through Public International Law” (Oxford University Press, 2008) pp 109-112.

² Denis Odigie and Eunice Erhagbe ‘renewable energy in mitigation of harsh effects of climate change’ 2021 (2) IUJJIL IGBINEDION UNIVERSITY JOURNAL OF JURISPRUDENCE & INTERNATIONAL LAW.

³ While renewable energy is often thought of as a new technology, harnessing nature’s power has long been used for heating, transportation, lighting, and more. Wind has powered boats to sail the seas and windmills to grind grain. The sun has provided warmth during the day and helped kindle fires to last into the evening.

⁴ UN ‘What is Renewable Energy’ <https://www.un.org/en/climatechange/what-is-renewable-energy> accessed 27 November 2022

Fossil fuels - coal, oil and gas - on the other hand, are non-renewable resources that take hundreds of millions of years to form. Fossil fuels, when burned to produce energy, cause harmful greenhouse gas emissions, such as carbon dioxide.

Generating renewable energy creates far lower emissions than burning fossil fuels. Transitioning from fossil fuels, which currently account for the lion's share of emissions, to renewable energy is key to addressing the climate crisis.

3. Sources of Renewable Energy

Harnessing renewable energy for mitigating climate change has become imperative in order to save the earth and reduce the negative impact of environmental pollution on man's quality of life. A good number of renewable energy sources have been identified and found beneficial to mankind and they are discussed below.

I. Solar Energy

Solar energy is the most abundant of all energy resources and can even be harnessed in cloudy weather. The rate at which solar energy is intercepted by the Earth is about 10,000 times greater than the rate at which humankind consumes energy.⁵ Humans have been harnessing solar energy for thousands of years—to grow crops, stay warm, and dry foods. According to the National Renewable Energy Laboratory, “more energy from the sun falls on the earth in one hour than is used by everyone in the world in one year.” Today, we use the sun's rays in many ways—to heat homes and businesses, to warm water, and to power devices.⁶

Solar, or photovoltaic (PV), cells are made from silicon or other materials that transform sunlight directly into electricity. Distributed solar systems generate electricity locally for homes and businesses, either through rooftop panels or community projects that power entire neighbourhoods.⁷ Solar farms can generate enough power for thousands of homes, using mirrors

⁵ UN 'What is Renewable Energy' <https://www.un.org/en/climatechange/what-is-renewable-energy> accessed 27 November 2022.

⁶ NRDC 'Renewable Energy: The Clean Facts' <https://www.nrdc.org/stories/renewable-energy-clean-facts> accessed 27 November 2022.

⁷ NRDC (Natural Resources Defense Council) was founded in 1970 by a group of law students and attorneys at the forefront of the environmental movement.

to concentrate sunlight across acres of solar cells. Floating solar farms-or “floatovoltaics”-can be an effective use of wastewater facilities and bodies of water that aren’t ecologically sensitive.⁸

Solar energy systems don’t produce air pollutants or greenhouse gases, and as long as they are responsibly sited, most solar panels have few environmental impacts beyond the manufacturing process.

II. Wind Energy

Wind energy harnesses the kinetic energy of moving air by using large wind turbines located on land (onshore) or in sea- or freshwater (offshore). Wind energy has been used for millennia, but onshore and offshore wind energy technologies have evolved over the last few years to maximize the electricity produced - with taller turbines and larger rotor diameters.⁹

Though average wind speeds vary considerably by location, the world’s technical potential for wind energy exceeds global electricity production, and ample potential exists in most regions of the world to enable significant wind energy deployment.

Many parts of the world have strong wind speeds, but the best locations for generating wind power are sometimes remote ones. Offshore wind power offers tremendous potential.

III. Geothermal Energy

Geothermal energy utilizes the accessible thermal energy from the Earth’s interior. Heat is extracted from geothermal reservoirs using wells or other means. Reservoirs that are naturally sufficiently hot and permeable are called hydrothermal reservoirs, whereas reservoirs that are sufficiently hot but that are improved with hydraulic stimulation are called enhanced geothermal systems.¹⁰

If you’ve ever relaxed in a hot spring, you’ve used geothermal energy. The earth’s core is about as hot as the sun’s surface, due to the slow decay of radioactive particles in rocks at the center of the planet. Drilling deep wells brings very hot underground water to the surface as a hydrothermal resource, which is then pumped through a turbine to create electricity. Geothermal

⁸ Ibid.

⁹ UN ‘What is Renewable Energy’ <https://www.un.org/en/climatechange/what-is-renewable-energy> accessed 27 November 2022.

¹⁰ Ibid.

plants typically have low emissions if they pump the steam and water they use back into the reservoir.¹¹

IV. Hydro Energy

Hydropower harnesses the energy of water moving from higher to lower elevations. It can be generated from reservoirs and rivers. Reservoir hydropower plants rely on stored water in a reservoir, while run-of-river hydropower plants harness energy from the available flow of the river.

Hydropower reservoirs often have multiple uses - providing drinking water, water for irrigation, flood and drought control, navigation services, as well as energy supply. Hydropower currently is the largest source of renewable energy in the electricity sector. It relies on generally stable rainfall patterns, and can be negatively impacted by climate-induced droughts or changes to ecosystems which impact rainfall patterns.

The infrastructure needed to create hydropower can also impact on ecosystems in adverse ways. For this reason, many consider small-scale hydro a more environmentally-friendly option, and especially suitable for communities in remote locations.¹²

V. Biomass Energy

Bioenergy is produced from a variety of organic materials, called biomass, such as wood, charcoal, dung and other manures for heat and power production, and agricultural crops for liquid biofuels. Biogas is a renewable energy source in the category of biofuels and it refers to gas produced by the biological breakdown of organic matter in the absence of oxygen. Biogas has been defined as methane produced by the process of anaerobic digestion of organic materials by anaerobes. In other words, biogas is the anaerobic digestion or fermentation of bio degradable materials such as biomass, manure, sewage, municipal wastes, green waste, plant material and crops.¹³

¹¹ NRDC 'Renewable Energy: The Clean Facts' <https://www.nrdc.org/stories/renewable-energy-clean-facts> accessed 27 November 2022.

¹² Ibid.

¹³ Yong, Zihan, Yulin Dong, Xu Zhang, and Tianwei Tan. "Anaerobic co-digestion of food waste and straw for biogas production." *Renewable energy* 78 (2015) Elsevier, England: 528.

Agriculture forms an integral part of the Nigerian economy with great potentials for employment generation, food production, poverty alleviation and wealth creation. In spite of these considerable contributions towards economic growth and development, the sector still encounters grave challenges which include Poor storage facilities, inadequate mechanization, Unavailability and poor utilization of improved planting materials. Although some of these challenges have been receiving varying levels of attention from the Federal Ministry of Agriculture, management of agricultural wastes has not been made a priority. Agricultural activities generate different types of wastes in its daily operations which include Solid wastes and liquid wastes.

4. Institutional Framework on Renewable Energy

The jurisdiction to establish a legal and regulatory framework for power generation, which may be pro-RE such as the one that establishes a legal requirement to make proportionate purchases of RE, or the stipulation of a Feed-in-Tariff (“FIT”) for RE, is largely within the sole purview of the FGN and its industry regulator, the National Electricity Regulatory Commission (NERC).

Similarly, the power to legislate on a fiscal and investment regime for RE such as the creation of key incentives for the promotion of utility-based electricity from renewable sources is largely within the jurisdiction of the Federal Government of Nigeria (FGN). The FGN controls regulation of electricity industry activities, particularly the activities of operators that are connected to the national electricity grid controlled by the Transmission Company of Nigeria (TCN), and this regulation is instrumental in the energy industry as it largely affects the industry sector and development. What is more? The FGN is solely responsible for legislating on the taxation of incomes and capital gains in Nigeria, and it has the sole legislative authority to prescribe fiscal incentives and tax breaks for RE companies in Nigeria. These facts make the role of the federal government important in the implementation of RE initiatives.

The federal government has produced a number of regulations containing policies and rules for regulating the RE industry. These include the National Electric Power Policy 2001,¹⁴ National Energy Policy 2003,¹⁵ Electric Power Sector Reform Act 2004,¹⁶ RE Master Plan 2005

¹⁴ The National Electric Power Policy (NEPP) of 2001 was the precursor to the Electric Power Sector Reform

RE Policy Guidelines 2006, Biofuel Policy and incentives 2007,¹⁷ Rural Electrification Policy, Nigerian MDG 2000, the National Economic Empowerment and Development Strategy (NEEDS) 2003-2007, and the IRENA statute ratified in 2010. Not until the 2005 Master Plan and the 2006 policy guidelines were renewable energy part of the national power planning process.¹⁸

Towards achieving a sustainable regime of alternative power in Nigeria, public policy makers have established institutions and formulated policies for the harnessing and actualization of renewable energy. Some of these policies include the following:

I. The Renewable Energy Master Plan, 2005 (REMP)

REMP is a policy mandate of the Ministry of Environment in Nigeria designed to increase the contribution of renewable energy to about 10% of Nigerian total energy consumption by 2025.¹⁹ The REMP envisioned a gradual but steady transition from overdependence to less dependence on hydrocarbons as a primary source of energy and income to Nigeria. It ventured to employ specific stages of development in its attainment of these objectives such as, the short term (2005-2007), the medium term (2008-2015) and long term (2016- 2025) (Renewable Energy Master Plan, 2005). In the short term, crude oil is expected to play a dominant role in the economic development of the country while an energy transition from crude oil to a less carbon intensive economy is anticipated in the medium term. This anticipated transition is notably indispensable. On the other hand, the long term envisages a country that will significantly be less dependent on hydrocarbons.

(EPSR) Act of 2005. Most of the significant provisions of NEPP are included in the EPSR.

¹⁵ In the Policy Overview of the National Energy Policy, NEP, of August 2003, the overall thrust of the energy policy is stated as “optimal utilization of the nation’s energy resources for Sustainable Development”. The policy mandates the government to harness the hydropower, solar, biomass and wind energy potentials available in the country for electricity generation...

¹⁶ The Electric Power Sector Reform (EPSR) Act, 2004 liberalized the electricity sector and the duo of Nigerian Electricity Regulatory Commission and the Rural Electrification Agency. The Act emphasizes the role of renewable electricity in the overall energy mix, especially for expanding access to rural and remote areas.

¹⁷ Biofuel policy and incentives articulates for the use of E10 and B20 as automotive fuel and was approved by Federal Executive council in 2007. See FRN. 2007. Official Gazette of the Nigerian Bio-fuel Policy and Incentives. Zenith. http://www.zenithrenewable.com/downloads/doc_download/4-the-officialnigerian-bio-fuel-policy-and-incentives- . accessed 28 November 2022.

¹⁸ See Federal Ministry of Power and Steel. 2006. Renewable Electricity Policy Guidelines. Abuja:ICEED.3. <http://www.iceednigeria.org/workspace/uploads/dec.-2006.pdf> accessed 28 November 2022.

¹⁹ Renewable Energy Master Plan (REMP) 2005. Energy Commission of Nigeria (ECN) and United Nations Development Programme (UNDP). <http://www.spiderssolutionsnigeria.com/wp-content/> accessed 28 November 2022.

The overall objective of the REMP is to articulate a national vision, set targets and a road map for addressing key development challenges facing Nigeria through the accelerated development and exploitation of renewable energy. This it hopes to achieve through by developing a comprehensive platform for setting up renewable energy policies, providing legal instruments, technologies, manpower, infrastructure and markets so as to ensure that the visions and targets are realized.

II. National Renewable Energy and Energy Efficiency Policy (NREEEP), 2015

The NREEEP provides a general legislative framework for renewable energy and energy efficiency sectors in Nigeria and it was followed by the creation of a National Renewable Energy Action Plan (NREAP).²⁰ This policy document recognizes the multi-dimensional nature of energy and therefore addresses diverse issues such as renewable energy supply and utilization; renewable energy pricing and financing; legislation, regulation and standards; energy efficiency and conservation etc.

In 2018, the US Agency for International Development (USAID) in collaboration with Power Africa concluded the four-year Renewable Energy and Energy Efficiency Project in Nigeria. On a progressive note, this project has provided 261,938 Nigerian citizens with renewable energy through 16,600 connections in a bid to reduce carbon emissions.

In 2020, as part of the economic recovery process necessary due to the covid-19 pandemic, the Nigerian government launched the Solar Power Naija Project,²¹ which aims to roll out five million solar-based connections to off-grid communities. The project targets 25 million homes and is expected to create approximately 250,000 jobs. The estimated cost of the project has been pegged at US\$620 million, although there are plans to recoup the expenditure.²² As at April 2021, the Nigerian government had commenced the implementation of this project with the Jangefe community of the Roni Local Government Area in Jigawa State, where it received 1,000

²⁰ Olarewaju Odunowo 'Nigeria's Regulatory Environment Appears to Favour Renewables But There Are Major Issues' <https://techcabal.com/2018/09/15/nigerias-regulatory-environment-appears-to-favour-renewables-but-there-are-major-issues/> accessed 28 November 2022.

²¹ Babalwa Bungane, 'Nigeria Announces new Energy Access Project 'Solar Power Naija'', ESI Africa Online Publications (7 December 2020) <https://esi-africa.com/industry-sectors/renewable-energy/nigeria-announces-new-energy-access-project-solar-power-naija> accessed 29 November 2022.

²² Peter Hansen, 'Nigeria's Energy for All Solar Power Plan', Climate Scorecard Nigeria (2021) www.climatecorecard.org/2021/04/nigerias-energy-for-all-solar-power-plan accessed 30 November 2022.

solar home system connections for its population of approximately 5,000 people.²³ Thereafter, the project will continue across other states.

Another important development in the renewable energy sector of Nigeria is the Nigerian Electrification Programme, which was launched in 2019 by the federal government in the hopes of implementing progress and providing electricity through solar-powered plants. To facilitate the implementation of this project, through the Rural Electrification Agency (REA) the federal government secured financing for this project from the African Development Bank (US\$150 million), Africa Growing Together Fund (US\$50 million) and the World Bank (US\$350 million).²⁴

The European Union also made available the sum of €165 million for investment towards the development and implementation of renewable energy projects.²⁵ This investment seeks to cater for at least '90 million Nigerians and business owners who lack access to affordable renewably energy'.²⁶

In the most recent development, a collaboration between a Singapore-based renewable energy enterprise known as B&S Holding PTE and SUNNYFRED Global, a Nigerian investment entity, in partnership with other stakeholders, have settled arrangements to set up West Africa's largest solar photovoltaic (PV) farm in Nigeria. The farm, which is to be known as the Ashama 200MW/HR Solar PV Farm, will be located on about 304 hectares of land in the Ashama village, found in the Aniocha South Local Government Area of Delta State.

Recently, in an attempt to cushion the effects of the covid-19 pandemic, the Central Bank of Nigeria introduced a solar intervention fund that offers soft loans (5 per cent interest) to developers engaged in renewable projects who may obtain credit facilities up to 500 million naira.²⁷ In 2020, the Nigerian Federal Ministry of Power also invited competent bidders to tender for the construction of various off-grid solar systems and other energy infrastructure projects across the nation.

²³ Ibid.

²⁴ See www.tbridgevp.com/s/NEP-Latest-Report.pdf accessed 29 November 2022.

²⁵ See <https://energycapitalpower.com/2019/07/09/nigerias-renewable-energy-sector-gets-165-million-boost/> accessed 27 November 2022.

²⁶ See www.vanguardngr.com/2019/05/eu-unveils-solar-tree-contributes-165m-euros-for-renewable-energy-in-nigeria/ accessed 27 November 2022.

²⁷ See www.nipic.gov.ng/2020/09/15/cbn-unveils-solar-intervention-fund-fixes-n500m-maximum-limit/ (accessed 27 November 2022).

III. Climate Change Act, 2021

The Act seeks to provide a framework for achieving low greenhouse gas (GHG) emissions and to mainstream climate change actions into national plans and programmes. Apart from establishing the National Council on Climate Change (NCCC) which shall have the power to make policies and decisions on all matters relating to climate change in Nigeria, the Act also provides that the NCCC will collaborate with the Federal Inland Revenue Service (FIRS) to develop a mechanism for carbon tax in Nigeria. The proceeds from the carbon tax, as well as emissions trading among other sources of funds, will be used to fund the Climate Change Fund (the Fund) proposed by the Act.

The Act provides that the newly-established NCCC, in conjunction with the Ministries in charge of Environment, Budget and National Planning, will be responsible for formulating Nigeria's National Climate Change Action Plan (Action Plan) going forward. The Action Plan would include details about Nigeria's carbon budget - defined in the Act to mean the approved quantity of GHG emission that is acceptable over a specified time -, GHG emission profile for sectors of the economy; incentives for private and public entities that achieve their GHG emission reduction targets; the level of Nigeria's compliance with its international climate change commitments etc.

The Act also provides that the Action Plan would cover a five-year period, with the first plan expected to be produced no later than 12 months from the commencement of the Climate Change Act.

5. Discussion on Green Economy

Except a swift intervention takes place, by 2030, the dynamics of energy use may not vary much from what it is today. This is the concern especially in emerging economies such as Africa, South Asia and Pacific Asia that still rely heavily on fossil²⁸ sources and solid fuels for their energy needs. The role of legislation also would be to put in place policies that would be tailored to ensure accessibility on a reasonable cost basis. This might require microfinance organisations to provide the requisite subsidies and financial backing. The private sector participation is also essential to maintain the momentum of growth and through spreading of knowledge and knowhow to every potential entrepreneur and investor. The socio-political impacts of energy policy are quite numerous; for example putting in renewable energy

²⁸ Shonali Pachauri, Narasimha D. Rao et al., 'Access to Modern Energy: Assessment and Outlook for Developing and Emerging Regions' (International Institute for Applied Systems Analysis, Laxenburg, Austria).

infrastructure is quite expensive to build and makes a huge demand on each aspect of any nations' economy to put in place. The implication of this can be described in terms of negative growth. This is because the final output is at first almost too expensive for potential consumers. This will impact on the amount of units that may be demanded for in future. There is also need for additional environmental outreaches to achieve and maintain public health over wide areas. This is being done in many nations worldwide to reduce public health risks of the biotic component of the environment in such a way that risk to the inhabitants of places with high risk energy facilities are minimized.²⁹ It is left for government through the right policies and legislations to subsidize such plants to keep them running. But more importantly, the need to imbibe an energy mix becomes more imperative. For example, in South Africa, the coal reserve is fast depleting. This has made policy makers through legislation to think about other competitive energy sources. It is hoped that this balance will achieve the requisite balance to sustain growth and cushion all monumental costs. Brazil currently generates over 18% of its energy from renewable fuel such as biofuels.³⁰

A. Barriers to the use of Renewable energy as an Alternative Power Source

It is imperative to consider the barriers to the use of renewable energy as an alternate power source. The following are some of the barriers against the sustainable use of renewable energy; cost, haphazard and ineffective regulatory framework, poor awareness and identifiable standard, prevalent corruption, inadequate trained personnel, incoherent target, and etcetera.

I. The effect of Cost

It is argued that the development of renewable energy cost more than other conventional energy, resulting in cost-driven decisions and policies that impede the development of renewable energy. Renewable energy investments generally require higher amounts of financing for the capacity. In addition, the technologies may face high taxes and import duties, consequently exacerbating the high first-cost considerations when compared to other conventional energy technologies.

II. Lack of Regulatory Framework

Absence of a well-organized and effective regulatory framework on the use of renewable energy translates to lack of standards, direction, specific mandate backed by legislation. This gives room for laxity and non-commitment by stakeholders. The market for renewable energy accessories has no checks against importation and use of shoddy materials.

III. Poor Awareness and Standards

The low awareness of opportunities, standards and quality control from regulatory agencies towards the development of renewable energy resources are other significant factors that have hampered the development of renewable energy among public and private sectors. The implication of this is that it creates a market gap that results in higher risk perception for renewable energy projects.

IV. Corruption

²⁹ Steven A. Herman, (being a Memorandum from EPA Office of Enforcement and Compliance Assurance, to Regional Administrative office, (1 May 1998) available at <http://www.epa.gov/compliance/resources/policies/civil/seps/fnlisuphermnmem.pdf>

³⁰ O. Lichts, 'Industry Statistics: 2010 World Fuel Ethanol Production' Renewable Fuel Association.

Corruption is an endemic social vice and reprehensible act of economic sabotage that has unfortunately constituted a huge drawback on the socio-economic wellbeing of the society. No matter how lofty government policy on renewable energy may appear, it will continue to be in the realm of political grandstanding rather than reality. The fight against corruption by anti-graft agencies have yielded little or no positive results because the powers and machineries of the agencies have derailed from the core mandate as the coercive powers are more often deployed as vindictive tool against perceived political opponents.³¹

V. Inadequate trained Personnel

Paucity of trained personnel and professionals is a crucial factor inhibiting the development of energy efficiency in Nigeria.

VI. Incoherent Targets

Nigeria, also suffers from setting overambitious renewable energy targets that are often inharmonious between different policy instruments and deficient in both aims and implementation measure. For instance, while the government sets out policy objectives in the various policy documents, there appears to be inadequate provisions for financial support for achieving those objectives. The Nigerian feed-in tariff scheme is the only financial support mechanism instituted to help achieve renewable energy integration targets. While this support scheme is important as it aims to attract private investment to the renewable energy market, there is no other financial support in place to fund or support government implementation strategies to achieving its renewable energy policy objectives found both in the REMP and the NREEEP.

6. Conclusion and Recommendations

The importance of renewable energy to development cannot be overemphasized, as it plays a crucial role in ensuring access to energy services. Nigeria is endowed with significant renewable energy resources. However, these resources have not been utilized to meet the country's energy needs. There is no adequate legal regime for the integration of Nigeria's abundant renewable energy resources. The sustainability of the use of renewable energy in Nigeria will rely on the political will of the government to initiate and implement laws to enhance the development of renewable energy sources. The development of renewable energy technologies is a win-win strategy for a developing country like Nigeria. Increased investments on renewable energy will bring together climate protection, poverty reduction, technology development and job creation.

A. Recommendations

I. Legislation and Regulation

A strong legal framework remains one of the best strategy for the development of renewable energy for power generation in Nigeria. Achieving adequate energy supply from renewables requires the creation of appropriate policy framework of legal, fiscal and regulatory instruments that would attract domestic and international investments.³² As opined by Oniemola, "using the

³¹ Denis Odigie and Eunice Erhagbe 'renewable energy in mitigation of harsh effects of climate change' 2021 (2) IUJJIL IGBINEDION UNIVERSITY JOURNAL OF JURISPRUDENCE & INTERNATIONAL LAW. 62.

³² Chineke C, Nwachukwu R, Nwafor O, Ugboma E. & Ndukwu O. 'Much Ado About Little: Renewable Energy and Policy' (2015) 9 Journal of International Scientific Publications <http://www.scientificpublications.net/get/1000015/1432901545984409.pdf> accessed 28 November 2022.

law to integrate renewable energy into the Nigerian power sector will promote energy security and access, a clean environment and economic development.

II. Financing

Financing is an integral part in the development of renewable energy resources for power generation. It is a form of investment grants and other related facilities that create a competitive advantage that contributes to the development of renewable energy.³³ This strategy received remarkable success in India, where the India Renewable Energy Development Agency (IREDA) provided assistance in obtaining international multilateral agency loans and helped private power investors obtained commercial loans.³⁴

III. Research and Development

Research and development (R&D) present another avenue for the development of renewable energy sources in Nigeria. There is need for the Nigerian government to invest in R&D activities in renewable energy so as to enhance technological innovation. In this vein, the government can support the creation of a joint research synergy between a foreign research institution, research institutions in Nigeria and renewable energy development professionals who will bring about the execution and implementation of research results into practice. Also, the funding for R&D on renewable energy technologies either from the government or private sector to R&D centres can go a long way to support the realisation of technological innovation in renewable energy.

IV. Adequate Utilization

If renewable energy is adequately harnessed, it will substantially complement electricity supply and reduce energy poverty especially in rural communities. It has been argued that renewable energy has the ability to lift the poorest nations to new levels of prosperity.³⁵

V. Technology Transfer Measures

Another viable strategy that promotes the development of renewable energy is the transfer of technology from developed countries to developing countries. The development of renewable energy means little without the technology to support generation, transmission and delivery for consumption.³⁶ Its development takes into consideration account storage, integration and monitoring, through hardware and software.³⁷ Therefore, the transfer of technologies from industrialised developed countries is critical if developing countries are to take advantage of modern renewable technologies for the development of renewable energy to boost power generation.

VI. Tax-based incentives and Policies

³³ Peter K. Oniemola, 'Integrating Renewable Energy into Nigeria's Energy Mix through the Law: Lessons from Germany' 2 Renewable Energy Law and Policy Review (2011) 29 p. 5

³⁴ Ibid.

³⁵ Steve Leone, "U.N. Secretary-General: Renewables can End Energy Poverty." (2011) Renewable Energy World.

³⁶ Morgan Henrie and Annie McIntyre, "Renewable Energy Projects: Project Management Opportunities, Challenges, and Risks" available on the Internet at <<http://www.asapm.org/asapmag/articles/Renewables10-2008.pdf>> accessed 26 November 2022.

³⁷ Ibid.

The incorporation of tax-based incentives and policies towards renewable energy offers an avenue for its development and serve as deterrence for carbon-based electricity generation.³⁸ Its exemption from taxation generally, can significantly reduce the cost of production. This can be done through the reduction of tax rates on income from the generation of renewable electricity. It has been argued that incentives encouraging the consumption of renewable energy sources will result in investment in renewable, while the imposition of taxes on conventional energy sources will reduce their consumption. To this end, tax-based incentives for renewable energies in Nigeria, where sufficient by nature are likely to influence investors, consequently, boosting electricity generation.

VII. Target Setting

Another means of promoting renewable electricity generation is through the setting of nationwide targets. Target based standards establish a target metric of renewable energy or energy efficiency achievement and require regulated industry to achieve the goal. The target is often stated as a percentage (%) of total production or in terms of Megawatt hours (MWh). When countries mandate levels of renewable energy production, national utilities can meet these targets in several ways; through their own generation; by purchasing renewable electricity generated by other producers; or through direct sales from third parties to the utility's customers.



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³⁸ Shahrouz Abolhosseini and Almas Heshmati, 'The Main Support Mechanisms to Finance Renewable Energy Development' (2014) 40 Renewable and Sustainable Energy Reviews 876, 880.