

# RENEWABLE ENERGY DEPLOYMENT IN NIGERIA

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## I. INTRODUCTION

The significance of energy resources cannot be overemphasized, as they are essential in virtually all sectors of the economy. Electricity is the most widely used and desirable form of energy globally. It plays a substantial role in the socio-economic and technological development of a country. In addition, the electricity demands of a country multiply with an increase in population and economic development.<sup>1</sup> The global drive for future socioeconomic growth and sustainable development will require low cost, clean and renewable sources of energy.<sup>2</sup>

Nigeria is endowed with abundant energy resources, which if utilised optimally can potentially provide the country with a sufficient capacity to meet the ambitions of both urban and rural Nigerians of a full, nationwide electrification level. Yet, Nigeria has one of the lowest consumption rates of electricity per capita in Africa. The achievement of clean energy as part of the 17 Sustainable Development Goals, is the responsibility of every member of the United Nations, including Nigeria.<sup>3</sup> The lack of sufficient

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<sup>1</sup> S. O. Oyedepo, "On Energy for Sustainable Development in Nigeria," *Renewable and Sustainable Energy Reviews*, vol.16, no. 5, pp. 2583–2598, 2012.

<sup>2</sup> W.C. Turkenburg, J. Beurskens, A. Faaij, P. Fraenkel, I. Fridleifsson, E. Lysen, D. Mills, J.R. Moreira, L.J. Nilsson, and A. Schaap, "Renewable energy technologies". *World energy assessment: Energy and the challenge of sustainability*, 2000: p. 219-272.

<sup>3</sup> Giwa, A., Alabi, A., Yusuf, A., & Olukan, T.; "A Comprehensive Review on Biomass and Solar Energy for Sustainable Energy Generation in Nigeria". (2017) *Renewable and Sustainable Energy Reviews*, 69, 620-641. United Nations Development Programme; Sustainable development goals (SDGs) at <https://sdgs.un.org/goals> [Accessed December 2, 2020]

power from the available energy sources is part of the major factors affecting the economic growth of Nigeria.<sup>4</sup>

To further elaborate on this, there are two broad forms of energy, which are;

1. Conventional or Non-renewable Energy
2. Renewable Energy

**Non-renewable Energy:** These are sometimes referred to as “dirty” energy. They include fossil fuels such as oil, gas, and coal. Non-renewable sources of energy are only available in limited amounts and take a long time to replenish. When one buys gas at the station, they are using a finite resource refined from crude oil that has been around since prehistoric times. Deposits of non-renewable energy sources are found in specific parts of the world, in abundant quantities making them more plentiful in some nations than others. In the same vein, while most countries have access to sunshine and wind for example, their respective endowment levels differ. This puts some countries in an advantageous position to substantially harness their solar and/ or wind energy potentials. Thus prioritizing renewable energy deployment can also improve a country’s economic dependence, environmental stability, and energy security by increasing access to electricity and reducing a country’s reliance on exports from fossil fuel-rich nations.<sup>5</sup>

Most non-renewable energy sources have adverse effects on the environment and human health. For example, the technology associated with hydraulic fracturing (fracking) can cause earthquakes and water pollution which affects sources of drinking water and kills aquatic life; carbon emissions from coal power plants foul the air, etc. These activities contribute to global warming.

**Renewable Energy:** On the other hand, alternative sources of energy, particular renewable, are growing rapidly in many parts of the globe. The innovation in many cases has proven to deliver on the quest for a clean and free energy future. It also endures a more cost-efficient electricity supply system in the long run. Gradually, they are displacing dirty fossil fuels in the power sector, bringing about the much-needed reduction in various forms of pollution. Renewable energy often referred to as pure energy, comes from natural sources or processes that are constantly replenished or cannot be depleted. For example, sunlight and wind amongst others are some of the most easily available renewables in Nigeria. They keep shining and blowing, even if their availability depends on time and weather. Nature’s clean power sources have for long being used for heating, lighting transportation, etc. Wind

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<sup>4</sup>Brimmo, A. T., Sodiq, A., Sofela, S., &Kolo, I.; *“Sustainable Energy Development in Nigeria: Wind, Hydropower, Geothermal and Nuclear” (Vol. 1).* (2017) *Renewable and Sustainable Energy Reviews*, 74, 474-490.

<sup>5</sup> Lora Shin, *“Renewable Energy, the clean facts: Wind and solar are powering a clean energy revolution. Here’s what you need to know about renewable and how you can help make an impact at home”*. [Accessed February 5, 2020].

has been used to power boats to sail the seas and windmills to grind grain.<sup>6</sup> The sun has provided warmth during the day and helped kindle fires to last into the evening. Thus these power generation techniques can be described as renewable since they are not depleting any resource to create energy. However, over the past 500 years or so, humans started departing from these clean power sources and increasingly turned to dirtier energy sources such as coal, crude oil, and natural gas to meet their basic daily needs.<sup>7</sup>

## II. LEGAL FRAMEWORK OF RENEWABLE ENERGY IN NIGERIA

The global search for ‘green’, sustainable energy sources has been driven largely by the increasing need for energy to power industrial, manufacturing and domestic activities in a sustainable manner. It is aimed also to address environmental degradation, and the national and global economic consequences of fluctuation in oil and gas prices.<sup>8</sup> Ironically, despite its global recognition as one of the major producers and exporters of crude oil, Nigeria is a major importer of refined petroleum products. This situation is largely responsible for the inadequate supply of fuel to generate reliable energy, and also necessitates a rapid shift from the total dependence on fossil fuels to renewables.

Power generation and distribution in Nigeria have been perpetually described as ‘epileptic’, hardly a befitting tag for an economy projected to be among the top 20 world economies by 2020.<sup>9</sup> According to the African Development Bank (2009), the unstable electricity supply is by far the most binding constraint to doing business in Nigeria.<sup>10</sup> Perennially in search of dependable solutions to its energy problems, Nigeria had initiated legislation and policies to drive its renewable power subsector.<sup>11</sup> The Nigerian renewable energy (RE) policy is fundamentally:

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<sup>6</sup>Edomah, N., “On the Path to Sustainability: Key issues on Nigeria’s Sustainable Energy Development”. (2016) Energy Reports, 2, 28-34.

<sup>7</sup><https://www.nrdc.org/issues/clean-energy> [Accessed February 5, 2020.]

<sup>8</sup>JamaOnwubuariri, “*Reviewing the Legal Framework for Renewable Energy Projects in Nigeria*” Published February 12, 2015.[Accessed February 5, 2020] Green energy means energy supply that is clean and from natural resources such as sunlight, wind, water, etc and are naturally replenished. It is power obtained from sources that cause no harm to the environment.

<sup>9</sup>Ibid, Part of the 7-Point Agenda of the President Yar’Adua Administration in 2007, adopted by the Jonathan Administration from 2009. [Accessed February 5, 2020]

<sup>10</sup>JamaOnwubuariri, “*Reviewing the Legal Framework for Renewable Energy Projects in Nigeria*” Published February 12, 2015.[Accessed February 5, 2020]

<sup>11</sup> From the establishment of ECN in 1951, the Niger Dams Authority in 1962 to develop hydroelectricity and the merger thereof with ECN to form NEPA in 1972. The National Electric Power Policy (NEPP) was established in 2001 to drive the power sector reform and subsequently led to the EPSRA in 2005. [Accessed February 5, 2020]

- target-based, seeking ambitious achievements relating to (a) increasing RE generation/distribution and (b) reducing dependence on traditional energy sources;
- not standard-centric, neither wholly tailored against any specific internationally accepted standards nor establishing a unique standard for Nigeria-based projects; and
- complementary neither proposed as a stand-alone solution to Nigeria’s energy needs nor as a wholesale replacement of traditional energy sources.<sup>12</sup>

Following this, there have been various enactments including laws, policies, and regulations issued by Nigerian Electricity Regulatory Commission (NERC)<sup>13</sup> to handle the need for renewable energy implementation in Nigeria. The fundamental ones are the following:<sup>14</sup>

1. Constitution of the Federal Republic of Nigeria, 1999 (as amended),<sup>15</sup>
2. Electric Power Sector Reform Act (EPSRA), 2005,
3. Nigerian Electricity Management Services Act, 2014,
4. NERC (Independent Electricity Distribution Networks) Regulations,
5. NERC Regulations for Mini-Grid Systems,
6. NERC (Embedded Generation) Regulations, 2012,
7. NERC (Eligible Customer) Regulations, 2017,
8. NERC (Permits for Captive Power Generation) Regulation, 2008,
9. NERC Regulations for Feed-In-Tariffs for Renewable Energy Sourced in Nigeria (REFIT Regulations),
10. Environmental Impact Assessment Act, 1992,
11. National Renewable Energy and Energy Efficiency Policy (NREEEP), 2015,<sup>16</sup>
12. Renewable Energy Policy Guidelines (REPG), 2006, and
13. National Electric Power Policy (NEEP), 2001.

The government ministries, department and agencies saddled with implementing, executing and overseeing these legislation on renewable energy in Nigeria are the following;

1. Nigerian Electricity Regulatory Commission (NERC),
2. Federal Ministry of Power,
3. Energy Commission of Nigeria (ECN),

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<sup>12</sup>JamaOnwubuariri, “*Reviewing the Legal Framework for Renewable Energy Projects in Nigeria*”. Published February 12, 2015 [Accessed February 5, 2020]

<sup>13</sup><https://nerc.gov.ng/index.php/component/remository/Regulations/orderby,4/page,3/?Itemid=0> [Accessed June 11, 2020]

<sup>14</sup> Ibid

<sup>15</sup> Constitution of the Federal Republic of Nigeria (As amended) LFN 2004

<sup>16</sup>PriscilliaOffiong, “*Spotlight Activity: National Renewable Energy and Energy Efficiency Policy (NREEEP)*” [Accessed February 5, 2020.]

4. Federal Ministry of Environment,
5. Nigeria Electricity Management Services Agency (NEMSA),
6. National Environmental Standards & Regulations Enforcement Agency (NESREA),
7. Rural Electrification Agency (REA),
8. State Ministries of Energy,<sup>17</sup>
9. State Ministries of Environment, and
10. All other government agencies and departments proposed by the various policies.

Most of the government agencies and commissions in the electric power sector seem to have similar objectives and perform overlapping functions, which, in many cases, leads to unnecessary bureaucracy and uncertainty.<sup>18</sup> The electric power policies were created to improve the stability of electricity supply, ensure cost recovery, attract and incentivize investments and finance, usher in a competitive energy market, provide direct and indirect employment, and regulate/monitor the Nigerian electricity supply industry.<sup>19</sup> However, the absence of an effective and transparent regulatory framework to enable Nigeria to harness its renewable energy potentials and attract potential investors has contributed to the high rate of electricity poverty, hence the need to expand the regulatory framework to accommodate alternative energy sources.<sup>20</sup>

Furthermore, not only are policies made or laws promulgated, but there is also a need for the implementation of these statutory provisions. The poor integration of Renewable Energy Technologies (RETs) into the Nigerian energy mix can be attributed to weak institutional framework, poor policy implementation, and lack of awareness.<sup>21</sup> Some countries have successfully developed their clean energy industries, and this is because of their comprehensible and stable regulations and policy frameworks that support renewable energy deployment. These countries include Brazil (bio-ethanol), Germany (offshore and onshore wind; biogas), Australia (wind; solar), Kenya (geothermal; solar), South Africa (solar; nuclear power) etc. Hence, the need for an effective legal framework in Nigeria towards clean and reliable sources of energy cannot be overemphasized.

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<sup>17</sup>[https://nigeria.ahk.de/fileadmin/AHK\\_Nigeria/4. Legal\\_and\\_Regulatory\\_Framework\\_for\\_Renewable\\_Projects\\_19Jun2019\\_Final.pdf](https://nigeria.ahk.de/fileadmin/AHK_Nigeria/4. Legal_and_Regulatory_Framework_for_Renewable_Projects_19Jun2019_Final.pdf) [Accessed June 10, 2020]

<sup>18</sup> Sambo, A.S. *The Place of Renewable Energy in the Nigerian Energy Sector*. Paper presented at the World Future Council Workshop on Renewable Energy Policies, 10 October, 2009, Addis Ababa.

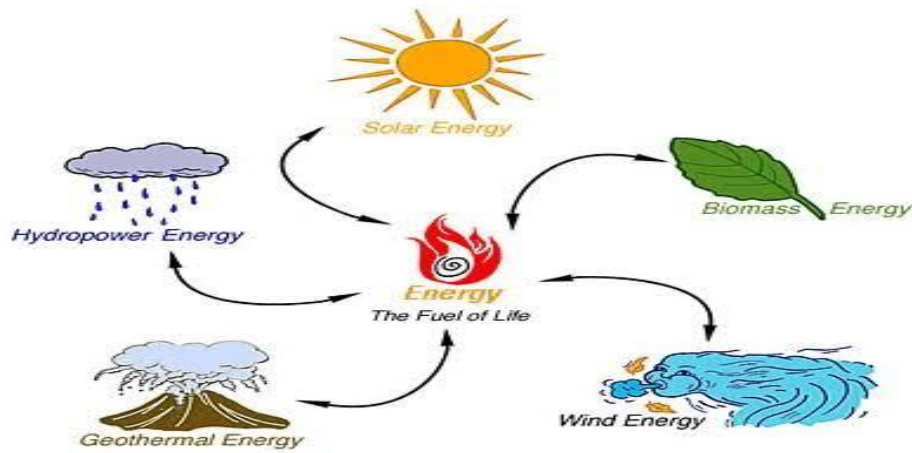
<sup>19</sup> Mercy O. Erhun & Daniel O. Johnson, "A Legal Framework for Sustainable Electrical Energy Industry in Nigeria Energy and Environment Research"; Vol. 8, No. 2; 2018. ISSN 1927-0569 E-ISSN 1927-0577 Published by Canadian Centre of Science and Education.

<sup>20</sup> Nigerian Society of Chemical Engineering (NSCHE), "The Role of Independent Power Project (IPP) in Meeting Power Demands in Nigeria" 2005

<sup>21</sup>E.O. Eleri, O. Ugwu, and P. Onuvae, 'Low-carbon Africa: Nigeria', International Centre for Energy, Environment & Development ICEED: Abuja Nigeria 2011.

### III. TYPES OF RENEWABLE ENERGY

There are various types of renewable sources ranging from nuclear energy, tidal energy, wave power, geothermal energy, radiant, etc. Our discussion, however, will be focussed on the renewable sources enumerated below because of their peculiarity to the Nigerian context.<sup>22</sup>



**Figure: Types of Renewable Energy<sup>23</sup>**

1. Hydroelectric power: Hydroelectricity is electricity generated by hydropower, i.e., the production of power through the use of the gravitational force of falling or flowing water.<sup>24</sup> Simply, energy generated from water. Hydro power has been in Nigeria for a long time and still is the country's main source of power.<sup>25</sup> It is the most widely used form of renewable energy as it has a low-carbon emission rate. Small scale hydro or micro-hydro power has been an increasingly popular alternative energy source, especially in remote areas where other power sources are not viable. Currently, Nigeria has some notable hydropower infrastructure located at Kainji, Jebba, and Shiroro, all located in Niger State. The question now bothers on the functionality of these hydroelectric stations.<sup>26</sup>
2. Biomass energy: Biomass, as a renewable energy source refers to living and recently dead biological materials that can be used as biofuel to power homes and industrial activities, as well as produce heat for cooking. Biomass includes plant matter grown to generate electricity or produce heat, for example, plant matter (dead trees and branches, yard clippings, and wood

<sup>22</sup> Alex Hanton, "Top 10 Renewable Energy Sources" <https://listverse-wpengine.netdna-ssl.com/fdl.txt> [Accessed February 5, 2020.]

<sup>23</sup> Pinterest in <https://www.pinterest.com/amp/pin/104638391313144507/>

<sup>24</sup> Alex Hanton, "Top 10 Renewable Energy Sources" <https://listverse-wpengine.netdna-ssl.com/fdl.txt> [Accessed February 5, 2020.]

<sup>25</sup> Akuru, U. B., Onukwube, I. E., Okoro, O. I., & Obe, E. S., "Towards 100% renewable energy in Nigeria. (2017) *Renewable and Sustainable Energy Reviews*", 71, 943-953.

<sup>26</sup> Michael Dioha, "Nigeria's Renewable Energy Policy: A Fantasy or Reality?" Published 28<sup>th</sup> November 2018 [Accessed February 5, 2020]

chips biofuel), and it also includes animal matter used for the production of fibres, chemicals, or heat. Biomass may also include biodegradable wastes that can be burnt as fuel. Industrial biomass can be grown from numerous types of plants, including hemp, corn, poplar, willow, sorghum, sugarcane, and a variety of tree species, ranging from eucalyptus to oil palm (palm oil).

Different forms of biomass exist in Nigeria, ranging from agricultural residue, fuelwood, and solid waste.<sup>27</sup> If only these wastes could be taken off the streets and employed to good use, one can succeed in significantly alleviating the electricity poverty of a nation. This form of renewable energy would also help Nigeria manage its poor waste management system, thereby ‘killing two birds with one stone’. Unfortunately, there is no commercial waste-to-energy plant in Nigeria. While there are whispers of the Lagos State government’s plan to collect all the waste in the city and channel them towards bio-energy generation, we are however yet to see this neither actualized nor hear any further plans on how it is to be executed.<sup>28</sup> There is so much bio-waste on the streets; there is however need for a working biomass plant in which to channel this bio-waste to improve the nation’s electricity supply.

3. Wind power: Wind power is the conversion of wind to energy by wind turbines into a useful form, such as electricity or mechanical energy. Large-scale wind farms are typically connected to the local power transmission network with small turbines used to provide electricity to isolated areas. Wind energy can be deployed on-shore and off-shore, as can be seen in Germany<sup>29</sup> and some other European countries. Wind energy has historically been used directly to propel sailing ships or converted into mechanical energy for pumping water or grinding grain, but the principal application of wind power today is the generation of electricity. Some studies such as the renewable Energy Master Plan by the Energy Commission of Nigeria, have shown that there are some wind sites in Jos, Sokoto, Kano and Funtua. However, wind energy is yet to be fully developed in Nigeria, but recourse may be given to the two wind farms under construction in Plateau, and Katsina.<sup>30</sup>

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<sup>27</sup> Food and Agricultural Organization (FOA), ‘Bioenergy Terminology’ [www.foa.org/docrep/007j4504E/j450e07.htm](http://www.foa.org/docrep/007j4504E/j450e07.htm) [Accessed June 16, 2020]

<sup>28</sup> Michael Dioha, “Nigeria’s Renewable Energy Policy: A Fantasy or Reality?” Published 28<sup>th</sup> November, 2018 [Accessed February 5, 2020]

<sup>29</sup> Markus Bohme and Carsten Bartholl, ‘Germany’ in Karen B Wong (ed), *The Renewable Energy Law Review* (Law Business Research, 2019) 45.

<sup>30</sup> (Kaduna: Shukrah Printers, 2005); Lahmeyer International and Federal Ministry of Science and Technology Nigeria, *Wind Energy Resources Mapping and Related Work Project*, (Abuja: 2004).

4. Solar energy: There are two types of solar energy simply identified by the way they are used. Active solar energy is used to either create electricity through the photovoltaic process or through the solar thermal process. Photovoltaic (PV) Solar Power is the process of harnessing the sun's energy to produce electricity. This occurs when sunlight is hitting a photovoltaic cell which is in turn converted into electricity by a semiconductor. Solar Thermal Power, on the other hand, produces heat from the sun's rays and uses it directly or converts it into mechanical energy and in turn electricity (that is, Concentrated Solar Power-CSP).<sup>31</sup> Solar Power is one of the fastest-growing energy sources, new technologies are developing at a rapid pace. Solar cells are becoming more efficient, transportable, and even flexible, allowing for easy installation. PV has mainly been used to power small and medium-sized applications. Solar installations in recent years have also largely begun to expand into residential areas, with governments offering incentive programs to make "green" energy a more economically viable option.

This is one renewable energy resource that nature has abundantly blessed Nigeria with, especially in the northern region. Research has opined that if 1% of Nigeria's landmass is used for Solar PV electricity generation, it is capable of producing around 207,000 GWh of electricity per year which is more than enough to satisfy Nigeria's energy requirements.<sup>32</sup> Like many RE systems, large-scale solar plants can be deployed to support conventional energy plants in the generation and servicing of electricity to the grid. However, the major challenge is: how much of the grid lines have been or will be installed and extended to communities that have historically lacked access to electricity? Expanding the grid to provide the much needed access to electricity to hitherto unserved areas, particularly rural and remote communities have historically failed to yield desirable outcomes in rapid electrification due to different factors ranging from high-cost implications to the infeasibility of grid expansion projects in certain topographies.

Therefore, installing more solar power infrastructure to service the insufficient grid system will only end up providing more power to already served areas, leaving out areas that do not enjoy the presence of the grid. However, the solar technologies available are few off-grid systems in the rural areas; solar street lights and decentralized rooftop Solar PV systems,<sup>33</sup> which is quite unfortunate because Nigeria's scorching sun could be harnessed to upscale access to electricity and support local productivity. This is why the current discourse in industry circles regarding

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<sup>31</sup>Planete Energies, *"The Two Types of Solar Energy"*. Cited in <https://www.planete-energies.com/en/medias/close/two-types-solar-energy> [Accessed June 10, 2020].

<sup>32</sup> Michael Diaoha, *"Nigeria's Renewable Energy Policy: A Fantasy or Reality?"* Published 28<sup>th</sup> November 2018. [Accessed February 5, 2020]

<sup>33</sup> Ibid



RE is revolving around deploying RE systems, especially solar power, in mini-grid or off-grid modes, particularly in rural areas as the most feasible strategy for enhancing rapid access to electricity in Nigeria.

That notwithstanding, some state governments are going about certain initiatives. For example, in December 2018, the Kaduna state government signed a Memorandum of Understanding (MoU) with a clean energy development company in connection with the development of a 30MW solar photovoltaic plant.<sup>34</sup> Likewise, the Nasarawa state government signed a Power Purchase Agreement (PPA) with Kuber Power Limited in connection with the proposed development of a 200MW solar power generation plant, which upon completion, is expected to be one of the biggest solar power plants in Africa.<sup>35</sup> If solar can be harnessed into PVs or solar thermal power in the homes and industries, the country's dependence on hydro and fuel would be greatly reduced.<sup>36</sup>

#### **IV. BENEFITS OF RENEWABLE ENERGY**

1. Renewable energy comes from a source that will never deplete, such as, sun, water, wind, etc.
2. With renewable energy, there is little or no harmful emission into the atmosphere.
3. It can drastically improve public health as pollution is a major contributor to ill health.
4. Renewable energy is stable and dependable.
5. It encourages job creation and helps eradicate unemployment which would be a welcome development in Nigerian society.
6. RE can be produced locally with RE technologies, thereby lowering the dependence on foreign energy sources.
7. Although many renewable energy plants have high installation costs, they generally are not subject to the same tariff rise as fossil fuels. Where the tariff tends to rise, many countries have subsidy or rebate schemes for their RE systems, which stabilizes and makes the tariff affordable.
8. Renewable energy is presently gaining a lot of attention and in the future will be the interest of many, so an early start makes for a better experience.

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<sup>34</sup><https://nipc.gov.ng/2018/12/12/kaduna-state-to-develop-30mw-solar-pv-plant>

<sup>35</sup><https://www.nasarawastate.gov.ng/biggestsolar.php>

<sup>36</sup>Ohunakin, O. S., Adaramola, M. S., Oyewola, O. M., & Fagbenle, R. O. (2014); *"Solar Energy Applications and Development in Nigeria: Drivers and Barriers"*. *Renewable and Sustainable Energy Reviews*, 32, 294-301.

## **V. RENEWABLE ENERGIES HAVE SEVERAL DISADVANTAGES INCLUDING:**

1. Not all forms of renewable energy are commercially viable.
2. Some forms of renewable energy are location specific.
3. Renewable energy may require storage facilities because the sun and wind for example don't happen all day and that may end up being more expensive for the simple man.
4. Pollution is still generated by some form of renewable energy e.g Biomass energy.
5. Some forms of renewable energy requires a large amount of space for generation e.g solar energy.

## **VI. CONCLUSION AND RECOMMENDATIONS**

The advantages and disadvantages of these renewable show us that this technology has great potential where strategically harnessed and deployed. Renewable energy policy has been successful in many countries; the same has also failed in some other countries. Nigeria can only look at these failures and successes to attain a suitable and feasible renewable energy policy. More so, not only do we require good laws and policies that support renewable energy deployment, but we also need to understand the need for the actualization of these plans and policies. To do that, renewable energy policy and legal implementation would require the total involvement of the government in ensuring technological development, financial investment, public awareness, and above all, the tackling of corruption in a patriotic spirit in the electricity sector. Policies such as the NREEEP should be given legal effect by the National Assembly, perhaps as subsidiary legislation to the EPSRA, to mandate the government's attention to the development of the renewable energy sub-sector in Nigeria.

Furthermore, there is a need for a robust review of the electricity sector to enhance sustainable economic growth. Policy measures and appropriate actions aimed at overcoming barriers to sustainable electric energy production and consumption needs to be adopted. Adequate and attractive institutional and legislative framework that will attract private capital and managerial resources in the energy sector needs to be put in place.<sup>37</sup>

Nigeria requires the strong political will of its government, simplification of its administrative structure, and a strategic review of the Nigerian electric supply industry to achieve its commendable objectives from all the promulgated policies towards achieving clean energy. Nigeria is blessed with renewable energy resources that could be harnessed to provide various modern energy services and

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<sup>37</sup> Mercy. O. Ehun& Daniel Johnson, "A legal Framework for Sustainable Electrical Energy Industry in Nigeria" November 26, 2018. [Accessed February 5, 2020.]

which could have played an essential role in the effort to alleviate poverty in the country. Paying attention to the renewable energy sector is critical to reducing the age-long dependence on imported oil and has the ability to lower national debts, thereby improving economic conditions to the benefit of the poor.<sup>38</sup> Furthermore, policy implementation must be prioritized and monitored by all the ministries and government agencies charged with RETs in the country.<sup>39</sup> There is no doubt that with the effective and appropriate development and management of renewable energy, Nigeria's economy will come on the path of progress, which will positively impact on concerted efforts to overcome Nigeria's other socio-economic challenges.

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<sup>38</sup> Ibid

<sup>39</sup> AbubakarYahaya Muhammad, Mohammed GamboAbdullahi, NmaYakubu Mohammed; 'Critical Factors Affecting the Development and Diffusion of Renewable Energy Technologies in Nigeria'. Journal of Multidisciplinary Engineering Science and Technology (JMEST) ISSN: 3159-0040 Vol. 2 Issue 8, August – 2015 [www.jmest.org](http://www.jmest.org) JMESTN42351013 2260