Solar energy development and implementation in Nigeria: drivers and barriers.

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2017

Solar Energy Development and Implementation in Nigeria: Drivers and Barriers

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Abstract

The over dependency on fossil fuel in Nigeria could be one big reason for the total failure of the power sector. The country's economic development which depends on productivity output is in peril due to the imminent energy crisis from gas shortage, vandalism, diminishing fossil fuel reserve and energy insecurity. Therefore, a strategic initiative to diversify the power sector into the energy mix to withstand the socioeconomic development has not indicated a positive progress. The insufficient electricity generation at the highest point was only in capacity put at 5000 MW in April 2015 to support a teeming population of about 184 million people. Nigeria is endowed with plentiful natural resources in which solar energy received more attention due to its potential, especially the rural communities. It is estimated that the solar potential deposit raises to 4,849, 782 kWh/m^2 days for the entire country of around 923,768 km2 areas. The theoretical framework is based on critical literature reviews being part of a PhD research. The research discusses the motivational drivers to the solar energy development and the barriers hindering the implementation. The key drivers were climate change, energy demand, power sector reform Act, energy security, supply versus demand conflicts, job opportunities, technology growth and market potentials. On the other hand, the key barriers are technical, social, economical, institutional and political. Recommendations of measures to surmount the barriers to facilitate implementation are also proffered.

Keywords: Solar energy, energy access, solar barriers, solar drivers, implementation

1. Introduction

There is little or no doubt that access to electricity is crucial to people, not only in the urban developed cities, but also to the development of rural areas. Even though, Nigeria is the biggest producer of Oil and Gas in Africa, 65% of its population lives in rural areas as peasant farmers without access to electricity (Duke, et al. 2016). Surprisingly, the total installed solar power in Germany is seven times more than the highest peak ever generated electricity from all sources in Nigeria, being 5000 MW in April 2015 (Edkins, et al. 2014). Nigeria located on the equator is within a high sunshine belt where solar radiation is potentially well distributed, especially over the Northern part of the country (Okoye and Taylan, 2017). Even though, the solar radiation distribution varies from 3.5kWh/m2/day within the coastal area and 7.0 kWh/m2/day in the northern part of the country (Ohunakin, et al., 2014). This result to earn the country a total solar radiation of 4,849, 782 kWh/m2 day covering the area of 923, 768 Km2of landmark (Akinyele, et al. 2007). Despite the potential solar radiation in the country, the technology is yet to find a sustainable strategy to be harnessed and put into the energy mix to solve the alarming energy crisis especially the electricity.

2. Status of Solar Energy in Nigeria

The whole of the continent is blessed with a great sunshine radiation, excluding the large areas of tropical rainforests (the Guinean Forests of West Africa and much of the Congo Basin), since desert and savannah regions of Africa stand up as the Earth's largest cloud-free area. The eastern Sahara/northeastern Africa is particularly noted for its world sunshine records: the area experiences not only the greatest mean annual duration of bright sunshine approximately as much as 4,300 hours, which is equal to 97% of the possible total but also the highest mean annual values of solar radiation (the maximum recorded was over 220 kcal/cm²) (Edkins, et al. 2014).

The distribution of solar resources across Africa is uniform, with more than 85% of the continent's landscape receiving a global solar horizontal irradiation at or over 2,000 kWh/ (m² year). Also, the theoretical reserves of Africa's solar energy are estimated at 60,000,000 TWh/year, which accounts for almost 40% of the global total, thus definitely making Africa the most sun-rich continent in the world (Nevin, 2016). Declining solar equipment

doi:10.18086/swc.2017.16.01 Available at http://proceedings.ises.org

costs are expected to significantly increase solar installations in Africa with an industry projection forecasting that the continent's annual PV market will expand to 2.2 GW by 2018 (Obeng, 2015).

Furthermore, harvesting solar energy in Africa tend not to be found within the equatorial and subequatorial climate zones, that are located in the western part of Central Africa usually near the equator, but that extends as far north and south as the 8th or 9th parallel in both hemispheres, since they are systematically linked with almost permanent cloud cover and only intermittent bright sunshine (Sharife, 2014). Therefore, African countries that entirely lie in this wet-humid zone, such as the Republic of the Congo, Equatorial Guinea, Gabon, Liberia and Sierra Leone are by far the least favoured in solar power of the entire continent. In contrast, many perpetually sunny African nations like Egypt, Libya, Niger and Namibia could rely on developing their tremendous solar resources on a large scale and at reduced prices (Sharife, 2014).

Tab.1: Maximum/minimum yearly global solar radiation in Nigeria (kWh/m2/day)

Stations	Location Longitude	Location Latitude	Altitude M	Maximum A	Minimum B	Monthly Average
Abeokuta	7.25	3.42	150	4.819	3.474	4.258
Abuja	9.27	7.03	305	5.899	4.359	5.337
Akure	7.25	5.08	295	5.172	3.811	4.485
Azare	11.8	10.3	380	6.028	5.022	5.757
Bauchi	10.37	9.8	666.5	6.134	4.886	5.714
Benin city	6.32	5.677.52	77.52	4.615	3.616	4.202
Calabar	4.97	8.35	6.314	4.545	3.324	3.925
Enugu	6.47	7.55	141.5	5.085	3.974	4.539
Ibadan	7.43	3.9	227.23	5.185	3.622	4.616
Ilorin	4.48	4.58	307.3	5.544	4.096	4.979
Jos	9.87	4.97	1285.58	6.536	4.539	5.653
Kaduna	10.6	7.45	645.38	6.107	4.446	5.672
Kano	12.05	8.53	472.14	6.391	5.563	6.003
Katsina	13.02	7.68	517.2	5.855	3.656	4.766
Lagos	6.58	3.33	39.35	5.013	3.771	4.256
Lokoja	7.78	6.74	151.4	5.639	4.68	5.035
Maiduguri	11.85	13.08	383.8	6.754	5.426	6.176
Makurdi	7.73	8.53	112.85	5.656	4.41	5.077
Minna	9.62	6.53	258.64	5.897	4.41	5.427
New Bussa	9.7	4.48	152	5.533	4.15	4.952
Nguru	12.9	10.47	342	8.004	6.326	6.66
Ubudu	6.63	9.08	305	5.151	3.375	4.224
Oweri	5.48	7.03	120	4.649	3.684	4.146
Port Harcourt	4.85	7.02	19.55	4.576	3.543	4.023
Serti	7.5	11.3	610	4.727	3.972	4.488
Sokoto	13.02	5.25	350.75	6.29	5.221	5.92
Wari	5.52	5.73	6.1	4.237	3.261	3.748
Yola	9.23	12.47	186.05	6.371	4.974	5.774

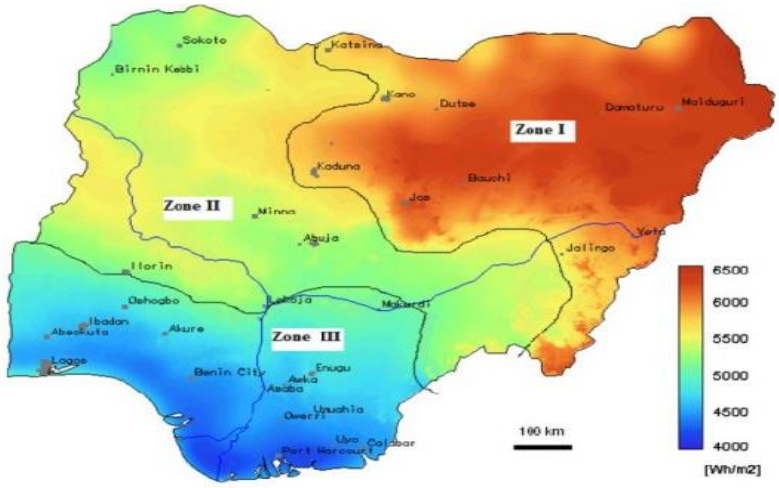
Source: Emodi and Boo, 2015

Table 1 above, is a view of Nigerian maximum and minimum sun radiation in various zones with highest radiation in the North-East Zone Nguru, Maiduguri, Kano and Azare in Bauchi state. However, other cities also possess high sun radiation making it equally potential for solar energy resources. Even the leas radiation

cities such as Warri and Calabar, the solar energy can potentially be harnessed by many users for household and small and medium businesses.

Figure 1 bellow shows the solar radiation distribution across Nigeria, where each zone is labelled to ascertain solar radiation contribution if the technology is harnessed. The three-different solar zone can be defined viz: Zone I, II and III where each zone having a diverse level of radiation that can be articulated for a specific project selection across the 36 states of the federation. It is evident that Zone I which comprises the states in the northeast zone have the highest solar radiation occurrence with excellent solar PV potential. Equally, zone II, which consist of the North-central and North-West have viable solar radiation while zone III has low solar radiation potential for big solar project selection in the country.

Figure 1: Solar Irradiation levels in Nigeria



Source: NESP, 2015

It is evident that the northern part of Nigeria can generate substantial solar energy as seen in table1; with annual radiation rising up to 6.966 maximum in Nguru Yobe state in the North- East and 3.78 minimum in the Wari Delta state, South- South of Nigeria. The next table will show the major solar projects both public and private with license to generate, operate and commercialise solar energy in Nigeria.

3. Solar Energy Projects in Nigeria

There are more than 58 energy mix projects going on in Nigeria, of which 35 are Solar-based from licensed solar energy promoters, including rural electrification projects, with a total capacity of 115 MW of Photovoltaic combining mini-grids and stand-alone installed (ECN, 2014). The Solar-based projects are installed for residential and commercial purpose respectively. Even though, the Ministry of Power launch a project in 2014, known as ‘‘Operation Light Up Rural Nigeria’’ most of the Solar projects is targeted for rural communities which are estimated only 10% of the population have access to electricity. Other off-grid projects include the 37 Federal Universities and University teaching hospital projects are underway to complement the electricity supply. Four of the Universities and a teaching hospital has already signed the Engineering, Procurement and Construction (EPC) agreement to develop mini-grid solution to power facilities of up to 9.3MW of solar PV and 5,760 battery cells will be deployed for the projects. Other projects are monitored by the federal ministry of power and the rural electrification agency, energy commission and the regulator (NERC) accordingly (ECN, 2018).

Tab 2; Major Solar projects in Nigeria

S/N	Name of Solar projects	Capacity (MW)	Type	Location	Proponent
1	Anjeed Kafanchan Solar Ltd	50	Solar	Kaduna	Anjeed Innoval Ltd
2	PV Grid – tied generator system	50	Solar	Osun	Book Solar Investment
3	Ever Power Solar power plant	50	Solar	Kaduna	Quaint Global Energy
4	Solar Farm Projects	200	Solar	Borno	Borno State Govt.
5	Solar Farm at Kado	59	Solar	Kaduna	Synergent powershire
6	Solar Indep. Power Project	100	Solar	Bauchi	Nigerian Solar Capital
7	Solar PV Power Projects	50	Solar	Sokoto	Geo Envi. services
8	Solar Farm Projects	30	Solar	Katsina	Katsina State Govt.
9	Japanese Grand Solar Power	0.9	Solar	FCT	Fed.Min. of Power
10	On-Grid Solar Power	200	Solar	FCT	99 Effect Energy Ltd
11	PV-Solar Farm Kankia	20	Solar	Katsina	Katsina State Govt.
12	Solar Project Danmarke	75	Solar	Zamfara	SPGS Power Ltd
13	Solar Power Plant Panyam	50	Solar	Plateau	CT Cosmos Ltd
14	Solar Farm Riko, Jibiya	10	Solar	Katsina	Sinosum Investment
15	Solar Gen. Plant Damaturu	1000	Solar	Yobe	GOPA Int.Energy Cslt
16	PV Power Plant FCT Area	100	Solar	FCT	LR-Aaron Power Ltd
17	Shiroro Solar Power Projects	300	Solar	Niger	N/South Power Co.Ltd
18	Solar Power Plant Irewole	50	Solar	Osun	Remix Energy Ltd
19	Solar Power Plant, Bakura	150	Solar	Zamfara	PV Bakura
20	Solar Power Plan Owo	25	Solar	Ondo	Secusafe Limited
21	Solar Farm Gusau	50	Solar	Zamfara	Sinosun Investment
22	Solar Farm Kiru	40	Solar	Kano	Bravos Energy Res.
23	Solar Project Kankia	125	Solar	Katsina	Nova Solar 5 Farms
24	Solar Energy Projects Udi	1200	Solar	Enugu	Motir Seapire Energy
25	Solar Power Plant, Ilorin South	150	Solar	Kwara	Oroceram Limited
26	Solar Power Plant, Paiko LGA	150	Solar	Niger	Oroceram Limited
27	Solar Power Plant, Dutse	75	Solar	Jigawa	PAS Dutse Ltd
38	Solar Power Plant Hadejia	75	Solar	Jigawa	PAS Dutse Ltd
39	Solar Power Projects Gwa AC	100	Solar	FCT	Enerlog Limited
30	Solar Projects, Yabo	100	Solar	Sokoto	KVK Power
31	Solar Power Plant, Kankia	80	Solar	Katsina	Pan African Solar Ltd
32	Solar Power Plant, Bakura	300	Solar	Zamfara	Bakura Energy Ltd
33	Solar Plant Kokona	50	Solar	Nasarawa	Afringia Power Ltd
34	Solar Power Plant, Numan	35	Solar	Adamawa	Hill Crest Env. Mgt Ltd
35	Renewable Energy Owo	10	Solar	Ondo	Gottpower Limited

Source: ECN, 2016; FME, 2016, NERC, 2016

The table above shows some solar energy promoters, they have applied, met the requirement stipulated by the Federal Ministry of Power, Nigerian Electricity Regulatory Commission and other Ministries, Departments and Agencies responsible for initiation of solar energy initiatives in Nigeria. The approval and issuance of licenses to solar energy companies is an indicator of the government and it agencies commitment to achieving a sustainable energy mix. The next paragraph will discuss factors that drives the solar energy implementation in Nigeria.

4. Drivers for solar energy initiatives in Nigeria

Beside the location of Nigeria on a belt where solar radiation is high, there are other factors which help in driving the opportunity for the deployment of solar energy initiative in the country.

Tab 3: key drivers for solar energy in Nigeria.

Drivers	Drivers Remarks
Sustainability demands (CO_2 footprint and Climate change)	Climate change is the main driver for solar energy and other renewable and the main trigger for the called for the Millenium Development Goals (MDGs) and Sustainable Development Goals (SDGs) over the Years (Uken, 2013). Nigeria is lying on the coastline of about 800 km, with sea level raised to 0.2 m and approximately 3400km sq. several kilometres of land have been found to lose annually (Ohunakin, et al. 2014). The raising of the sea level and the desertification is resulting from the burning issues of the rapid greenhouse emission caused by the other unsustainable means of electricity. The application and development of solar PV, could reduce the impact to a minimal level while tapping the free and clean energy and making our environment friendly, more sustainable and green (Darmani, et al. 2014).
Increased energy demand	Growth is expected to reach 270 million by 2030 at an average annual rate growth of 4.0% between 2000 and 2030. Population growth, therefore, is the main driver vis – a - vis the energy demand and the socioeconomic activities measured by the GDP (Oseni, 2012). Therefore, the rapidly growing demand for energy will create more opportunities for solar PV development in Nigeria, since the conventional source will be inadequate to feed the high demand of the energy in the country. Solar energy deployment is also a very big opportunity for the rural area socioeconomic activities, because most the rural communities are neither connected nor faced with an epileptic supply of electricity (Sambo and Bala, 2012).
Power Sector Reforms Laws	The Electric Power Sector Reform Act (EPSRA) 2005, made provisions of law, to allow private individuals to construct, operate, own and generate electricity not exceeding 1000 kW at a site without a license (Amankwah, 2015). The order for the exception is meant to ease the process protocol and delays in acquiring licenses and to empower young entrepreneurs to invest in the standalone power generation. The facility is also part of the electricity expansion of a national grid, facilitation of off-grid power system, generates renewable energy and coordinates other energy mix (Ohunakin, et al. 2014). The abundance of solar radiation makes solar potentially the most important source driven by the high demand of population in the country (Okoye and Taylan, 2017).
Energy Security and access	Nigeria is estimated to have 80% demand/supply gap in electricity, and it is also, estimated that only 10% of the rural communities have access to the electricity from the national grid (Aliyu, et al. 2015). Most public and private businesses are run by self-generated electricity using gasoline and diesel generators which emit high unhealthy greenhouse gases to the environment and unbearable noise to the society. Electricity energy is lost via a transmission through distribution to the end users (Emodi, 2015). Frequent, high voltage cable vandalism, cable theft, illegal connections, and inadequate maintenance of the power sector facilities and lack of trained human capacity development (Ohunakin, et al. 2014). Therefore, solar PV and solar thermal constitute safe, enabling, reliable and affordable alternative energy widely used.
To Neutralise the energy conflict	The Nigerian power sector plant is crippled with the inconsistence in the supply and demand of gas to power plant's equipment. The common cause is associated with sabotage and destruction by the militants around the oil and gas producing area; Niger Delta (Sambo and Bala, 2012. The solar energy source is free from sunlight, and requires no transport as it is produced near where it is consumed (Aliyu, et al. 2015). Therefore, the ability to generate, transmit and develop the solar energy free of conflict zone can be a pushing factor for solar and other renewable energy technology deployment and implementation in Nigeria.
Job Creation and Opportunities	The promotion of solar energy in Nigeria will contribute enormously to poverty reduction by engaging young people in local communities to participate and benefit from the opportunity in skills development, technology transfer and investment opportunities (Darman, et al. 2014). Many alternative energy pilot projects in developing countries give positive evidence of impact on socioeconomic development, especially the rural communities in Nigeria with abundant, natural resources Ohunakin, et al. 2014). The increase in the investment in the solar battery manufacturing, installations, maintenance and repair skills, and the manufacture of various solar devices leads to the creation of massive job opportunities.

Source: Alam, et al. 2010; Darmani, et al. 2014; Ohunakin, et al. 2014; Uken, 2013 and Zahedi, 2011; Akinyele, et al. 2017; Okoye and Taylan, 2017.

Tab. 4: Other drivers for solar energy in Nigeria

Drivers	Drivers Remarks
Local value-added potential	Developing countries like Nigeria will yield local added value for solar energy penetration, considering that less than 40% of the population are connected to the national grid. Most of the population is in the rural area where fuel wood is the main source of energy (Emodi and Boo, 2015). There is a potential for the solar applications technology to be developed locally by the rural dwellers to support an energy mix in various forms such as cooking, water pumping and other agricultural activities (Dittmar, 2008). Solar energy is also potential for promoting socioeconomic stability, skill acquisition and job creation.
Growth in Education and Technology	Growth in technology and widespread of technical knowledge of solar technology could be a reason driving the initiative in Nigeria (Amankwah, Amoah, 2015). Besides, energy research centres in Nsuka, Sokoto, Lagos, Ilorin, Bauchi and Port Harcourt are the roots to awareness and skills development for solar and other renewable energies in Nigeria (Oseni, 2012). The growth in technical knowhow about the technology locally, is a pulling actor potentially responsible for continued interest in solar energy.
Stakeholders Involvement	Solar and other renewable energy projects cannot succeed without the intervention of local stakeholders. When local entrepreneurs, explicitly integrates their investment towards solar energy technology, the success of the technology is achievable (Zahedi, 2011; Marques and Fuinhas, 2011. Therefore, local investors, entrepreneurs and end users are encouraged to fully participate in the promotion, generation, production and implementation of solar energy in Nigeria to help mitigate the appalling electricity shortage in the country (Ohunakin, et al. 2014).
Financing opportunities and Market potential	One of the barriers to solar and renewable implementation in developing countries are the inability to penetrate a market because the technology is yet to be known and accepted in many countries including Nigeria (Rettere and Kelley, 2010). However, incentive mechanism such as subsidies towards the initial financial cost of solar could play a vital role in promoting the technology. In Nigeria, solar projects are funded by World Bank Projects, Central Bank of Nigeria (CBN), USAID, and many other international development funding institutions to support the promotion and development of solar energy (Ohunakin, et al. 2014). These projects drive interest from young entrepreneurs and investors to diversify into the energy mix to support the mitigation of power outage in the country.

Source: Darmani, et al. 2014; Dittmar, 2008; Marques and Fuinhas, 2011; Ohunakin, et al. 2014; Uken, 2013; Akinyele, et al. 2017; Okoye and Taylan, 2017.

The table above discussed the driving forces for solar energy implementation in Nigeria. Each country's location might have potential factors that drive the implementation of the solar energy initiative. For developing countries solar energy can bring major benefits for socio-economic development, especially in the rural communities where access to electricity has become the biggest challenge. A switch from other oil and gas energy sources can reduce the over dependency on oil and gas supply with issues of insecurities and vandalisation. In the south and other developed countries gain the advantages to driving the renewable energy from international climate change agreements like the Kyoto Protocol, SDGs and from socioeconomic interest. In other words, fast economic growth countries like China, India, and Brazil are mandated to meet their energy demand while the poorer nations must meet the international poverty reduction goals which implies the reduction of energy poverty especially in the rural areas in Africa particularly Nigeria. These forces include the declining cost of RET capital cost, integration of private public partnership in the energy industry, growth in population and the increase in demand for energy, needs for the mitigation of climate change and the achievement of the SDGs targets, energy security, job creation and financing opportunities for RET projects by international organisations.

5. Key Barriers to Solar Initiatives in Nigeria

Despite the many benefits that can be accrued from the use of solar energy potential and uses, is still very low. The major impediments to the solar energy initiative's adoption are series of barriers identified through critical review of literature which makes it difficult to implement.

Table 4; Barriers to Solar energy implementation in Nigeria

Barriers category	Barriers	Remarks	Sources
Technical Barriers	Lack of skilled personnel, lack of code of standard, lack of maintenance and operation, lack of training facilities and entrepreneur's development mechanism, lack of reliable framework for sustainability.	The barriers lead to poor plans, poor standard, and constraints of the competitive market, inadequate knowledge to know-how for the technology and risk of acceptance resulting in technology locked -up.	Sambo & Bala, 2012; Painly, 2001; Luthra, et al. 2015. Ozoegwu, 2017
Social; Cultural Behaviour	Lack of consumer awareness about the product, lack of understanding of benefit of solar PV and public resistance to chance for new technology.	The barrier, affect the market projection negatively, cultural and religious faith controversies towards economic development and sustainability.	Pasqualetti, 2011; Pollmann, et al. 2014; Akinwale, et al. 2014. Akinyele et al. 2017
Economic/ Financial Barriers	Lack of access to capital, credit to consumers and financial instrument. Lack of support to R & D, high interest rate, import duties subsidies to support local manufacturing.	At the early stage, solar projects need incentives to encourage entrepreneurs. The barriers make it difficult to adopt and sustain due to financial constraints.	Shaaban & Petinrin, 2014; Emodi &Boo, 2015; Kar & Sharma, 2015.
Institutional / Legal barriers	Institutional barriers, legal framework, regulatory issues, non-integration of energy mix, non-participation of private sector, poor R & D culture and stakeholder's non-interference.	High risk of uncertainty for solar support, lobbies against RET, a poor mechanism to reach the institutional policy makers for improvement and negative perception about the technology.	Aliyu, et al. 2015; Charles, 2014.
Political/ Policies Issues	Lack of long term policies, lack of political will to diversify into clean energy, constantly changing of government and re-shuffling of institutions.	These barriers serve as a deterrent to future planning for solar and other renewable energy adoption and sustainability. There is the fear of uncertainty in government.	Sambo & Bala, 2012; Ohunakin, et al. 2014; Painuly, 2001.
Market Distortions Issues	Trade barrier for new product, energy sector controlled, lack of access to diversified technology, lack of facilities and backup technology, non-market oriented research for solar energy technology and application.	The barriers cause hindrance to market penetration and hence new technology failed at some point.	Ohunakin, et al. 2014; Fagbenle, et al. 2011. Ikejemba and Schuur, 2016

Even though, Nigeria possesses potential driving factors for solar energy players to promote the initiatives throughout the country, the deployment and implementation of the initiatives still faces major obstacles making the implementation very challenging. It is hoped that the private sector participation will help the government to come out with an achievable solar energy roadmap. The next section will discuss the method by which this research was carried out

6. Methodology

The method adopted for this inquiry was based on desk study, otherwise recognised as literature-based from peered-reviews. Rather, many of secondary based were searched from published resources 2003 through 2017, with key articles obtained from PsyCho Info, ERIC, ProQuest, Science Direct, SocSci Search, EBSCO and COPAC, which are systematically narrowed to a search of any information related to the driving factors responsible for solar energy initiatives and the barriers which served as an obstacle for the implementation. Relevant literature was themed for critical analysis in order to produce a research outcome. The outcome from the critical literature review is analysed and discussed in the next paragraph.

7. Findings

From the literature, it is evident that Nigeria has huge potentials for solar energy almost throughout the year especially the North-East zone of the country. In accordance with literature findings, the factors driving the solar energy technology include a demand for a sustainable environment to achieve the SDGs, increase in energy demand due to increase in population, Power sector reforms Act, which suggested energy mix, challenges of energy security and access, job creation, financing and market potential, the establishment of energy research centers and stakeholders in the public private partnership deals. Even though, the drivers failed the potential for solar energy initiatives in Nigeria, the industry is encircled by barriers which makes the implementation difficult and almost impossible. Lack of skill personnel, consumer awareness about the product, lack of access to financing, lack of institutional framework, lack of long term policies for sustainable energy and trade barriers are hindering the deployment of solar energy initiatives in Nigeria. The Nigerian socio-economic activities cannot achieve its maximum potential unless the electricity challenges are adequately address by harnessing the available solar energy potential.

8. Conclusion and Recommendation

In conclusion, Nigeria, being a country within the belt of high solar radiation, a huge potential for solar energy could be grabbed to help support the epileptic conventional electricity in the country. The country possessed enormous solar energy drivers, making it a big opportunity to harness the potential solar energy to integrate into other renewable available in the country. In spite of the driving forces for the solar radiation in the country, the implementation process is constricted with many barriers, making it implementation chances very narrow. Even though, the power sector reform saw a progress for diversifying strategy to help bailout the power sector, to the energy mix, the progress indicator traced little or no significant to nearly achieving its objectives.

The Nigerian government together with integration of public private partnership (PPP) need to aggressively pursue measures to mitigate the barriers for sustainable solar energy initiatives in the country by supporting local solar panels and batteries manufacturers and distributors. The abundant solar energy in Nigeria need to be harnessed effectively and integrated with other renewable energy such as wind, biomass and mini-grid to help solve the electricity challenges tumbling the economic development of the country.

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