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AMERICA OR INDIA: IDENTIFYING A SUITABLE OFF-GRID RURAL ELECTRIFICATION MODEL FOR NIGERIA

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ABSTRACT

Most Nigerian living in the rural areas lack access to electricity due to lack of connectivity to the national grid network. The national grid expansion strategy to rural areas has not yielded much result due to financing and centralised approach. Off-grid electricity is considered more suitable for rapid electrification of rural areas. This paper examined the American and Indian approach to rural electrification and derived suitable lessons for Nigeria. While America ensured a robust national grid network to service rural areas, India adopted the renewable energy based off-grid options, thereby becoming the fastest developing country in rural electrification.

Keywords: Rural Electrification, Off-grid, National Grid, Renewable Energy, Financing, Decentralisation

1. INTRODUCTION

In Nigeria, electricity generated for power plants is usually channelled into the national grid domiciled in the National Control Centre (NCC), Oshogbo, Osun State. It is from this central station that onward transmission of electricity is wheeled across the country through transmission lines known as the national grid system. The Federal Government of Nigeria has continued to make efforts to expand the grid system throughout the country. The government is, thus, saddled with the herculean task of spreading the grid across the expanse of complex landscape and large population size of the country. This requires very huge financial resource. The federal government have succeeded in expanding the grid to the capital city of each state and some urban areas.[1]

NERC (Independent Electricity Distribution Network) Regulation 2012 defines rural area to be 'any area of the country not existing within 10km from the boundaries of an urban area or city and which has less than 20,000 inhabitants or population density is less than 200 per square kilometre and which is at least 20km from the nearest existing 11KV line'.[2]Rural communities which are far off from the grid network do not have access to electricity. This is notwithstanding the fact that majority of Nigerian populace live in rural areas. Only 40% of Nigerians can access grid electricity while only 15% rural dwellers which constitute 70% of the entire population of the country have access to electricity.[3] Their energy needs are sourced from biomass fuel and generators for the few who can afford it. Even urban dwellers depend on the use of electric generating set to a large extent due to irregular and erratic power supply. While industrial consumption of electricity has been on the steady decline, residential consumption has been on the increase. This trend is premised on the constant shut down of small industries and big industries

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1 CA Awosope, 'Nigeria Electricity Industry: Issues, Challenges and Solutions', (2014) Covenant University 38th Public Lecture Series 3/2, 7.

2 Section 3 NERC IEDN Regulation

3 S.O Oyedepo, 'Towards Achieving Energy for Sustainable Development in Nigeria', (2014) 34 Renewable and Sustainable Energy Reviews 255, 256.

resort to the use of private electricity generator due to the inefficient supply from the national grid.[4] Nigeria is reportedly the highest importer of diesel powered electricity generators in the world.[5]

Nigeria's electricity deficiency situation is the second highest in the world after India.[6] This has been described as energy poverty.[7] Energy poverty is the severe inability to meet the energy needs of the people. It emanates from inability of the populace to access sufficient energy or afford the cost of accessing it.[8] Not just any type of energy, but modern energy is different from the traditional energy sourced from wood, animal droppings, shrub and pasture, etc.[9] These traditional sources of energy do not satisfy the five essentials of efficient energy which includes: availability of supply, affordability of the cost, adequacy of the supply, convenience of the supply and the reliability of the supply.[10] The current state of power sector in Nigeria does not meet up with the standard either.

The importance of off-grid electricity, especially in view of the Nigerian context, suggests that enough cannot be said about it. However, few attempts have been made to make an intense examination of the legal challenges that stand on the way of off-grid electricity in Nigeria at present and in the future. This situation informed the need to beam the searchlight on this aspect of the electricity sector for a thorough investigation of the state of

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[4] ibid.

[5] I Dunmade, 'Hybridizing Renewable Energy Systems in Nigeria: A Contextual Framework for their Sustainability Assessment', (2016) 4 (5) European Journal of Engineering and Technology33, 34.

[6] International Energy Agency and World Bank, 'Sustainable Energy for All: 2017-Progress toward Sustainable Energy' (2017*)* <www.worldbank.org/en/topic/energy/publication/global-tracking-framework-2017>accessed 6 June 2018.

[7] A Nwozor, S Oshewolo, & O Ogundele, 'Energy Poverty and Environmental Sustainability in Nigeria: An Exploratory Assessment', 331 (2019) (012033) IOP Conference Series: Earth and Environmental Science 1, 2.

[8] AA Adedeji, 'Spatial Exploration and Analysis of Electricity Poverty: A Case Study of Ibadan, Southwestern, Nigeria' (PhD thesis, University of Leicester 2016) 36.

[9] ibid. 2.

[10] ibid. 39; FO Ogbumike& UM Ozughalu, 'Analysis of Energy Poverty and its Implications for Sustainable Development in Nigeria', (2016) 21 Environment and Development Economics 273, 277; CE Nnaji, CC Uzoma & JO Chukwu, 'The Role of Renewable Energy Resources in Poverty Alleviation and Sustainable Development in Nigeria', (2010) 3 Continental Journal of Social Sciences 31, 33.

the law and the legal challenges inhibiting the development of off-grid electricity for rural areas. This paper shall compare the Nigerian situation with that of American and Indian jurisdictions in order to draw useful lessons therefrom. The choice of these two jurisdictions is informed by the following fact: In the first instance, given Nigeria's adoption of an American-styled democratic and federalist system, the legal and governmental structures of both countries are similar. Due to America's attainment of total electrification,[11]there are lessons which Nigeria can draw from this success story. On the other hand, Nigeria has so many similarities with India: both countries have very large population; both countries are regarded as developing countries, both countries have the highest record of poverty in the world; both countries have the world's highest record of energy deficit,[12]just to mention but a few. Thus, both countries are hub of off-grid opportunities. However, unlike Nigeria, India is fast advancing away from the negative status of poverty ridden nation. This advancement may be connected to the fast developing power sector in India. Again, there is need to examine the Indian system to see how they are addressing their power challenges to meet the energy needs of their very large population.

2. OFF-GRID ELECTRICITY IN RURAL ELECTRIFICATION

The Nigerian government has set its developmental goal to become one of the top 20 economies in the year 2020. The imperativeness of adequate and constant power supply towards creating an industrial economy cannot be over stated. It is one of the core enticement for foreign investment in the country.[13]In the past, some foreign investors have had reason to wind up production activities in Nigeria and relocated to Ghana which has

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[11] L Pellegrini, & L Tasciotti, 'Rural Electrification Now and Then: Comparing Contemporary Challenges in Developing Countries to the USA's Experience in Retrospect' (Forum for Development Studies 2012) 1.

[12] 'At the country level, India alone has a little less than one-third of the global deficit (270 million for electricity), followed by Nigeria.' International Bank for Reconstruction and Development. 2017. Overview: State of Report Electricity Access' (2017) 4 <documents.worldbank.org/.../pdf/114841-ESM-PUBLIC-P148200-32p-FINALSEAR-web-REV-optimized.pdf> accessed 10 August 2018.

[13] A Usman, 'Determinants of electricity Consumers Satisfaction in Selected Electricity Distribution Zones in Nigeria: Implications for Regulatory Activities', (2013) 3 (6) Journal of Asian Business Strategy 103, 121.

better condition of electric power supply.[14] In order to avoid a situation where existing investors exit the economy while new investors are apprehensive about putting their investment into the Nigerian economy due to inadequate power supply, the government set a target towards improving the electricity capacity of the country to 40,000MW by 2020. The approach adopted towards achieving this goal has grid expansion towards rural areas that lack access to the national grid network. Year 2020 had come and gone, yet the Nigerian power sector is yet to attain up to 5,000MW.[15]

The government has vigorously pursued grid development, howbeit unsuccessfully. Off-grid electricity supply option has been left largely unexplored. The two major power generation sources to the national grid are thermal and hydro power plant at the ratio of 80:20 respectively.[16]At the moment, hydro appears to be the only form of renewable energy that has been significantly explored into the Nigerian energy mix of the country. It is argued that off-grid, decentralised energy options sourced from renewable energy has a greater potential in quickly ensuring wider electricity supply reach to a greater section of the Nigerian population.[17]It is projected that off-grid options has the potency to supply electricity to 60% rural dwellers who lack access to electricity.[18]Notwithstanding the form of off-grid or renewable

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[14] 'Michelin, Dunlop Tyres Dumped Nigeria Because of Epileptic Power Supply – Stakeholder', Daily Post March 31, 2016. <dailypost.ng/2016/03/31/michelin-dunlop-tyres-dumped-nigeria-because-of-epileptic-power-supply-stakeholder/> (accessed June 16, 2021).

[15] KPMG, 'Nigeria's Electricity Supply Industry Highlights', (2021) 1 Power Sector Watch 2. 2021) 1 <https://assets.kpmg_pdf_tax_Power-sector-watch-2021-q1.pdf> (accessed June 16, 2021).

[16] Dalberg Global Development Advisors, 'Improving Access to Electricity through Decentralised Renewable Energy: Policy Analysis from India, Nigeria, Senegal and Uganda. (2017) 12. <https://www.dalberg.com/system/files/2017-07/Dalberg-offgrid-policy.pdf> (accessed June 6, 2021).

[17] HI Mshelia, 'Energy Access for All: The Role of Clean Energy in Alleviating Energy Poverty', Energy Access for All 33, 33.

[18] I Onyeji-Nwogu, M Bazilian, & T Moss. 'Challenges and Solutions for the Electricity Sector in African Markets', (Center for Global Development Policy Paper 2017) 12. <https://www.cgdev.org/publication/challenges-and-solutions-electricity-sector-africanmarkets-final.pdf> accessed 19 June 2018.

electricity source preferred, it will function as a sustainable compliment to the grid network.[19]

While the federal government is making time and resource-consuming efforts to expand the grid network across the nook and cranny of the country, it has been suggested that mini grid electricity could be developed as interim measures to timely service the energy needs of rural communities just like the case of Myanmar.[20]Notwithstanding the target of ensuring grid expansion to meet the energy needs of the people, governments of various countries have continued to use off-grid options to fast track electricity accessibility.[21] Off-grid connections have the capacity of speedily reaching more remote settlements many years earlier than the mono directional grid extension plan, thereby encouraging economic viability of rural areas.[22] It is also found that it is more expensive to expand the grid network to interior communities which are far away from the grid than development of off-grid systems. According to the Global Tracking Framework, it would cost only US$3 million to supply electricity through solar energy to 100,000 people in interior areas while achieving same feat via grid extension to those areas would cost about US$150 million.[23]

The huge population of rural dwellers that lack access to grid electric connectivity in Nigeria hassing led out the country as a hub of off-grid potentiality in Africa. A 2017 record places this figure at 77 million, translating into 40% of Nigerian populace.[24] The far reaching consensus from different quarters for the development of off-grid electricity in Nigeria and other countries is a testimony that off-grid energy options would go a long way to solve the electricity challenges of Nigeria.Off-grid electrification

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[19] EB Herbert, 'Developing a Renewable Energy Based Off-Grid Electricity Solution for Nigeria', (2021) 2 (2) Global Energy Law and Sustainability 182, 183.

[20] 'Nigeria Current State of Play' <https://learn.tearfund.org/...energy/2018-odi-tearfund-pioneering-power-country-report-Nigeria-En.pdf> accessed 6 June 2018.

[21] Global Off-Grid Lighting Association, 'Providing Energy Access through Off-Grid Solar: Guidance for Governments' 10<https://www.gogla.org/ .../energy_ access_through_off-grid_solar_-_guidance_for_govts.pdf>*acc*essed 6 June 2018.

[22] ibid.

[23] ibid. 9.

[24] MY Roche, H Verolme, C Agbaegbu, T Binnington, M Fischedick & EO Oladipo, 'Achieving Sustainable Development Goals in Nigeria's Power Sector: Assessment of Transition Pathways', (2020) 20 (7) Climate Policy 846, 846.

is a modern means of electricity sourcing other than the grid network with the use of mini-grid or stand-alone systems. Off-grid electricity sourced from renewable energy would be a great means of respite for the rural population of the country which have limited access to the national grid.[25] The off-grid potentials of Nigeria has the tendency to attract foreign direct investment into Nigerian power sector, especially in the aspect of small hydro and solar off-grid system.

Developmental challenges which have been found to limit plague rural communities' access to electricity, include: distance from the grid system, complex topography, unfriendly atmospheric conditions, etc.[26] Rural electrification is imperative in view of social, economic and environmental challenges which it solves. Despite statutory and policy effort to resolve these challenges, the problem persists. Legislative constriction, slow pace of critical legislative enactment and inconsistencies in government policies are part of the factors which has made these challenges persist.[27] The is in sharp contrast to the case of Ghana which have successfully utilised legal and policy framework, such as the Renewable Energy Act (832) 2011 and the Ghana Energy Development and Access Project policy, to address electrification challenges in rural areas, particularly the Island Communities of the Ghanaian Volta Region.[28]The efforts have yielded result towards the targeted infusion of up to 10% renewable energy into the energy mix of the country by 2020, through the deployment of solar photovoltaic mini-grid systems.[29]

Rural Electrification Programme was first launched in Nigeria in 1981 with the aspiration of getting, at least, each local government headquarters and certain adjoining towns and villages connected

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[25] O Daramola, 'Renewable Energy Market Analysis in Nigeria' (BSc thesis, Laurea University of Applied Sciences 2012) 110.

[26] CJ Diji, 'A Critical Assessment of the Nigerian Rural Electrification Policy' (2014) 2 (1) International Journal of Advanced Studies in Engineering and Scientific Inventions 118-130.

[27] Ibid.

[28] E Boateng, 'The Potential Socio-Economic and Environmental Impacts of Solar PV Mini-Grid Deployment on Local Communities: A Case Study of Rural Island Communities on the Volta Lake, Ghana' (MSc thesis, University of Jyväskylä 2016) 106.

[29] Ibid.

to the national grid.[30] Upon the enactment of the EPSRA, the programme was coordinated by the Federal Ministry of Power and Steel and PHCN until 2006 when the Rural Electrification Agency (REA) was formally launched upon which they handed over this duty to the Agency.[31] REA was established by the EPSRA with all the traits of an incorporated personality.[32] It consists of seven members who must be appointed from each of the geopolitical zones of the federation, possessing the technical ability and stakeholders' interest.[33] However, the Act does not state who appoints members of the Agency. The Act does not also make provision for the appointment of a chairperson for the agency. Judging from the excessive powers conferred on the Minister, it appears that the Minister is in charge of the agency.[34] The implication is that the agency is likely to be robbed of its independence.

The set objectives of the REA are to ensure the expansion of the national grid into rural areas; develop stand-alone and mini-grid systems and promote renewable energy based power generation.[35] The Act also established the Rural Electrification Fund (REF) for the purpose of actualising the goals of the Agency.[36] The duty conferred on the agency with respect to the promotion of stand-alone and mini-grid systems are commendable in view of the paradigm shift from the hitherto existing practice of focusing on national grid expansion in achieving rural electrification in Nigeria. However, the constitutionality of this provision of the

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[30] The International Bank for Reconstruction and Development, 'Nigeria: Expanding Access to Rural Infrastructure Issues and Options for Rural Electrification, Water Supply and Telecommunications' (Energy Sector Management Assistance Program Report 2005) 8 <https://www.esmap.org/file-download/26094/68669> accessed 6 June 2018.

[31] Deutsche Gesellschaft für Internationale Zusammenarbeit, 'The Nigerian Energy Sector: An Overview with a Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification' (2015) 51 <https://www.giz.de/en/downloads/giz2015-en-nigerian-energy-sector.pdf> accessed 10 August 2018.

[32] Section 88 (1) EPSRA 2005.

[33] Section 88 (2) (a) and (b) EPSRA 2005.

[34] For instance, it is the Minister that is tasked with the duty of creating the Rural Electrification Strategy and Plan (RESP) (Section 88 (4) EPSRA); presentation of RESP to the president (Section 88 (9) EPSRA); receives statements of account from the Agency (Section 88 (6) EPSRA 2005); the Minister to be consulted by the Agency in respect of their functions under Section 91 (1) and (2) etc.

[35] Section 88 (9) EPSRA 2005.

[36] Section 88 (13) EPSRA.

Act is questionable in view of the provisions of Item 14 (b) of the concurrent legislative list of the Constitution which expressly confer the states legislature with the power to make laws on off-grid electricity. Hence, there is need for the constituent states of the federation to create States Rural Electrification Agencies to fill this gap.[37]

In its technical report on Vision 2020 the Federal Government expressed desire to allow States and Local Governments expand grid connection to rural areas in their various states that lack access to grid connection and develop renewable energy dependent mini-grid systems to supply power into isolated habitats.[38] It would amount to states acting outside their scope of duty to expand grid connection. They also stand the risk of having the Federal Government hijacking such projects from them. The better option is to adopt off-grid solution, as they can find constitutional and legal basis to control and sustain it.

The proposed single federated and centrally coordinated rural electrification approach of 2015[39]assumes the one size fits all disposition, which operates on the faulty presumption that each community has similar challenge and peculiarity. The vast area constituting rural area in Nigeria causes one to wonder how a Minister and 7 REA members operating in Abuja can effectively handle the peculiar electrification challenges of these communities. This approach creates a 'knowledge problem': it is impossible to exhibit sufficient knowledge of a localised issue from a centralised position.[40] Generally formulated policies, no matter how well conceived and intended, would not translate to suitable solutions

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[37] A Oni, 'A Case for Nigerian Component State Governments to Develop Off-Grid' (2017) <http://rea.gov.ng/case-nigerian-component-state-governments-deve-lop-off-grid-renewable-policies-agencies-improve-power-generation-country/>ace-ssed 16 June 2018

[38] Federal Republic of Nigeria, 'Report of the Vision 2020' (National Technical Working Group on Energy Sector 2009) 69 <www.ibenaija. org/uploads /1/0/1/2/10128027/energy_ntwg_report.pdf> accessed 6 June, 2018.

[39] Federal Republic of Nigeria, 'Final Draft Rural Electrification Strategy & Plan' (2015) 9 <www.power.gov.ng/.../RURAL%20ELECTRIFICATION%20STRA-TEGIC%20IMPLEMENTATION%20PLAN%20RESIP.pdf> *accessed 10* Augu-st 2018.

[40] JH Adler, 'Interstate Competition and the Race to the Top', (2013) 35 (1) Harvard Journal of Law & Public Policy 89, 93.

for each locality considering their peculiarities.[41] A decentralised system has the advantage of local content, thereby giving rise to home grown solution. The merit of decentralised reforms is that, institutions saddled with the responsibilities of ensuring electricity supply take advantage of their closeness and understanding of the problem.[42]It is also easier for the people to trust institutions that are closer to them.[43]

3. FINANCING CONSTRAINTS FOR OFF-GRID RURAL ELECTRIFICATION

The cost effectiveness between developing off-grid connections and extension of grid connection to unserved areas depends on a lot of factors, such as: the distance of the grid to the area, the gauge of cables and poles required, and the demand for electricity.[44] The cost of renewable energy based off-grid systems is experiencing swift drop due to advancement of technology in that area.[45] Notwithstanding the recent drop in the price of the hydrocarbon, power generation based on solar and wind energy is fast attaining price parity with conventional hydrocarbon-based generation.[46]Mini-grid solutions are more appropriate and cost- effective for remote settlements especially where the demand and population density is quite high.[47] However, electricity undertaking, whether based on grid or off-grid connections, renewable or fossil fuel powered, the cost implication is quite exorbitant. Pulling through any of such

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[41] ibid.

[42] M Sulemana, 'Challenges of Decentralization as an Instrument to Sustainable Rural Development: The East Gonja District of Ghana as a Case Study', (2009) 11 (3) Journal of Sustainable Development in Africa 25, 27.

[43] S Feron, 'Sustainability of Off-grid Photovoltaic Systems for Rural Electrification in Developing Countries: A Review', (2016) 8 (12) Sustainability 1326, 1331.

[44] J Kennedy-Darling, N Hoyt, K Murao, & A Ross, 'The Energy Crisis of Nigeria: An Overview and Implications for the Future', (The University of Chicago 2008) 13 <franke.uchicago.edu/bigproblems/Energy/BP-Energy-Nigeria.pdf> accessed 6 June 2018.

[45] International Bank for Reconstruction and Development 'State of Electricity Access Report' (2017) xxii <https://openknowledge.worldbank.org/.../114841-WP-v2-FINALSEARwebopt.pdf?> accessed 19 July 2018

[46] ibid.

[47] Federal Republic of Nigeria, *'Final Draft Rural Electrification Strategy & Plan' (2015) 10* <www.power.gov.ng/.../RURAL%20ELECTRIFICATION%20STRATEGIC%20IMPLEMENTATION%20PLAN%20RESIP.pdf> *accessed 10 August 2018.*

undertaking is highly capital intensive and requires a large pool and source of financing.[48] It is reported that at least US$3.4 billion is required to be invested annually in order to deliver 12 GW capacity of off-grid electricity.[49]

In Nigeria, electricity development had been totally dependent on Federal government funding. The EPSRA was enacted in 2005 with the intention of changing that narrative by making room for private sector shareholding and investment in the power sector. At the moment the sector is partially privatised as the federal still holds large stake in the sector and is still the highest financier in the power sector. The Federal government also provides subsidies for electricity tariff and indigent consumers. Huge percentage of the annual national budget is dedicated for the purpose of funding the power sector. However, the extent to which the federal government would continue to do this is limited. The Federal government is saddled with very huge financial responsibilities which it has to offset especially due to the kind of federalism practised in Nigeria which places greater items of responsibility in the federal government. Various sector of the economy such as security,[50] education,[51] etc. are in hot competition for a huge chuck of the national budget. This implies that the dependence on the federal government for the financing of the power sector is no longer sustainable given the challenges herein highlighted.

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[48] A Rahmadi, H Hanifah, & H Kuntjara, 'Renewable Energy Investment in ASEAN: Opportunities and Challenges' (ASEAN Briefs 2 2017) 4 <admin.thcasean. org/assets/.../file/2017/.../ASEAN_Briefs,_Special_Volume_-_Vol2.pdf> accessed 16 June 2018.

[49] SC Bhattacharyya, 'Financing Energy Access and Off-Grid Electrification: A Review of Status, Options and Challenges', (2013) 462 (73) Renewable and Sustainable Energy Reviews 1, 11.

[50] The multifaceted insecurity situations in the country actuated by the Boko Haram terrorist activities in the North-East, MOSSOP secessionist uprising in the South-East, the Niger Delta militant activities in the South-South and the Fulani herdsmen attacks in the North-Central, demands lots of fund to deal with. For instance in April, 2018 $1 billion was spent for the purchase of six Tuscano fighter jets from United States of America to aid the countries fight against insurgency.

[51]There had been several agitations and industrial actions by Academic Staff of Universities Union to press home the demand for the earmark of 26 percent of the annual national budget for the funding of the education sector in line with the recommendations of the United Nations.

The recognition of the role of the private sector is financing of electricity undertaking, especially off-grid, is underscored by the enactment of the EPSRA. Private investors are stakeholders in the power sector. This was intended to be a supplementary means for the government efforts in the sector. Several attempts and initiative have been made by the government to encourage private sector investment especially foreign direct investment into the power sector. However, these initiatives get limited as most investors are discouraged by high incidence of corrupt practices, civil unrest, political instability and high criminal activities. Another factor that puts off investors is the issue of policy inconsistency by government in the reform process.[52] It had noted earlier that so many policies which do not accord with each other have been formulated by the Nigerian government for the power sector. Since these policies do not even have legal force, they leave room for uncertainties.

Private sectors can finance the power sector by pooling together contributions from their various shareholders. Private sector also offers the alternative of Private-Public-Partnership (PPP) or Build-Operate-Transfer (BOT) concessions[53] in power project implementation. Private sector may also access funds to meet their financial obligations in the power sector from commercial banks and stock exchange market. However, the accessibility of commercial loans for mini-grid projects is still a serious challenge. Commercial banks are reluctant in financing mini-grids projects as it does not present a tested business model and susceptible to high risk factors.[54] Commercial banks need the assurances of risk mitigating factors such as: application cost-reflective pricing, guarantees in the event of grid coverage of service area, foreign exchange stability, etc.[55] The interest rate of

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[52] The International Bank for Reconstruction and Development. 'Nigeria: Expanding Access to Rural Infrastructure Issues and Options for Rural Electrification, Water Supply and Telecommunications' (Energy Sector Management Assistance Program Report 2005) 8. <https://www.esmap.org/file-download/26094/68669> accessed 6 June 2018.

[53] J Olotu, 'Improving Power Delivery Across the Generation, Transmission and Distribution Value Chain' (PWC Annual Power and Utilities Roundtable: The challenges with Transforming the Nigerian Power Landscape 2016) 20, 21.

[54] M Lythgoe, 'Renewable Energy Generation in Argentina: Past failures and a Plan for Future Success', (2009) 31 (1) Houston Journal of International Law 263, 323.

[55] African Development Bank Group. 'Green Mini-Grids In Sub-Saharan Africa: Analysis Of Barriers To Growth and the Potential Role of the African Development

loan facilitated by commercial banks in Nigeria is another matter of serious concern. Central Bank of Nigeria's interest rate stood at 13% as at September, 2015, which implies that the corporate bodies and individuals could pay up to 22-28% of the principal sum as interest.[56]

The initial costs of off-grid energy supply are usually high. The major challenge with private sector financing for the power sector is that private investors are majorly concerned with short-term returns on their investment.[57] The shareholders are eager to gain dividends from their investment; pressure from credit facilitators are mounting; overhead cost is a recurring decimal. These needs have to be met. The government can incentivise private sector through rural investment allowance and pioneer status. Tax relief measures for carbon tax exemptions should be employed to encourage the use of renewable energy for off-grid schemes.[58] This would entail that Section 6 (b) NERC Regulation Feed-in-Tariff of Renewable Energy Sourced Electricity should be amended to include off-grid electricity. Otherwise there would be need for NERC to create another Feed in tariff regulations with special attention for off-grid electricity.

Section 88 (11) EPSRA creates the Rural Electrification Fund (REF) to be administered by the Rural Electrification Agency. The fund is to be sourced from: budgetary surpluses of NERC;[59] fines levied on defaulters of EPSRA;[60] donations, gifts or loans obtained from international organisations, State and Federal Government, local communities, corporations and other entities; contributions by eligible customers[61] and interest and benefits accruable to the REF; funds appropriated by National

Bank in Supporting the Sector', (Green Mini-Grids Market Development Programme 2016) 1, 24.

[56] Global Off Grid Lighting Association. 'Accelerating Access to Electricity in Africa with Off-Grid Solar. Country Briefing: Nigeria' (2016) 4. <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications...files/10252.pdf> accessed 10 August 2018.

[57] F Ganda, & CC Ngwakwe, 'Problems of Sustainable Energy in Sub-Saharan Africa and Possible Solutions', (2014)5 (6) Mediterranean Journal of Social Sciences453, 460.

[58] ibid.

[59] See, Section 53 EPSRA.

[60] This should extend to regulations made by NERC pursuant to EPSRA.

[61] See Section 90 EPSRA

Assembly for rural electrification; and NERC may also charge certain percentage of the annual income licensees.[62] The essence of the REF is to promote, initiate and support rural electrification projects. While the specific objectives of the fund are: attain equitable geographical spread of electricity access across the country; maximise the sustainable rural electrification subsidies; advance grid expansion and off-grid solution; encourage innovative approach means of rural electrification.[63] However, the Act precludes the use of the fund for the purpose of subsidies for electricity consumption.

RESIP 2016 urged state governments and local governments to make contributions to the REF. This is a mere restatement of the provisions of the Act. However, it had been herein canvassed that rural electrification would be better implemented at the state and local government level due to their proximity to the rural areas. States Rural Electrification Agencies should be created for the various states and the REF should be distributed equally to the constituent states for them to manage in accordance with their rural electrification needs. By so doing, competition would be stimulated amongst the states. It is difficult to get States and Local governments to make individual contributions into the mixed pool of REF, especially given the disparity in financial strength of the various states. To borrow the words of Chianu, this is like getting 'the horse and ass yoked'.[64] States should be allowed to develop their rural electrification needs at their own pace. This is because such money would be used to develop other communities in line with REA objective of attaining geographical spread, while the immediate communities of the contributing states do not get the direct benefit of the contributions of their governments. State and local governments would be more comfortable to make contributions into a state managed rural electrification agency.

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[62] See generally, Section 67 (12) EPSRA.
[63] Section 67 (13) EPSRA.
[64] See, E Chianu, 'The Horse and Ass Yoked: Legal Principles to Aid the Weak in a World of Unequals', (2007) University of Benin Inaugural Lectures Series, 91.

4. RURAL ELECTRIFICATION DEVELOPMENT IN THE UNITED STATES OF AMERICA.

America experiences rapid growth from 1900 such that as at 1930, 85 percent of the entire municipal and countryside non-farm residents had access to grid electricity. However, this success did not translate to American farms which had less than 10 percent access to electricity by then.[65] The population sparsity of rural areas made it unattractive and unprofitable for private utility companies to invest in rural electrification, as distribution line only served an average of three rural customers per mile as against the 50 to 200 city customers it would have served.[66] To fill this gap, several initiatives were launched by the federal government in the 1930s, amongst which was the Tennessee Valley Authority, created in 1933 by the Roosevelt government for the purpose of providing electricity supply at cheap rate to residents of rural areas.[67] Less than 13 percent of the farm households were electrified as at 1935.[68] This prompted the government to create the Rural Electrification Administration the following year.

The Rural Electrification Administration was created under by the Rural Electrification Act 1936. The body was created for the sole purpose of ensuring electricity supply to the isolated farms in the country by the provision of infrastructure and funding. It could only act as a financing institution and not to be directly involved in the execution of the project itself. Subject to the approval of the Senate, the President appoints an Administration who is to give effect to the Act for the tenure of ten years.[69] An amount of up to $50,000,000 was made available by the Reconstruction Finance Corporation as the take-off grant to enable the Agency provide long term loans and

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[65] J Lewis, and E Severnini, 'The Value of Rural Electricity: Evidence from the Rollout of the U.S. Power Grid' 3. <https://pdfs.semanticscholar.org/8202/a72b497eee7b74d2a7a82022412381d870da.pdf> accessed 5 September 2015.

[66] RT Beall, 'Rural Electrification' (1940) Yearbook of Agriculture 790, 794.

[67] J Lewis, & E Severnini, 'The Value Of Rural Electricity: Evidence from the Rollout of the U.S. Power Grid' (2014) 4. <www.economichistory.ca/pdfs/2014/lewisSevernini.pdf> accessed 5 September 2015.

[68] ibid.

[69] Section 1 Rural Electrification Act 1936.

financing of up to twenty-five years amortization period for the facilitation and management of power generating stations, power transmission and distribution network for the benefit of rural dwellers who are not served by the central station.[70] $50,000,000 was made available for the subsequent eight years of the single tenure of the Administrator, out of which only 50% would be available for allotment for loans.[71]

Other purpose of the financing includes: wiring of premises of rural dwellers and procurement and mounting of electrical appliances and plumbing equipments.[72] Campaigns were carried out in local communities to enlighten residents on the use and maintenance of appliances.[73] This category of financing was strategic. Many of the use less power supply in their households and this portends less profitability for the investors. This loan was made available to encourage them purchase electric appliances that would eventually increase their power consumption rate, electricity bill and consequently lead to increased business returns for the investors.

High degree of non-discrimination and transparency is expected of the Administrator in disbursing the loans amongst applicants. An Administrator found wanting in this regard is liable to be dismissed from office by the President.[74] The loan could be made in favour of the following category of persons: 'corporations, States, Territories, and subdivisions and agencies thereof, municipalities, people's utility districts and cooperative non-profit, or limited dividend associations organized under the laws of any State or Territory of the United State'[75] Rural communities across the U.S. established non-profit, farmer-owned cooperatives, taking out low-interest loans, becoming the major category of borrowers.[76] As at December 31, 1939, more than 92 percent of the fund of the agency was borrowed

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[70] Section 3 a. Rural Electrification Act 1936
[71] Section 3 b. and c. Rural Electrification Act 1936
[72] Section 3 a. Rural Electrification Act 1936
[73] AM Herscowitz, & K Auth, 'Electrifying Africa Based on the U.S. Rural Electrification Model' in H Schützeichel, (ed), Off-Grid-Industry Yearbook (Sun-Connect News 2018) 53, 53.
[74] Section 9 Rural Electrification Act 1936.
[75] Section 4 Rural Electrification Act 1936.
[76] Herscowitz, & Auth, (n 73)

by cooperative societies, public power districts borrowed up to 6 percent and the other fraction was obtained by public bodies.[77]

The strategies applied by the Agency towards the attainment of its objectives are highlighted as follows:

i. The agency was set up with the specific objective of dealing the electrification challenges in rural agrarian communities;[78]

ii. Credit facilities were made available to farming cooperative societies at subsidised and meagre interest rates with lengthy repayment plan;[79]

iii. Aggressive campaigns, publicity and wide circulation of print materials were embarked upon to enlighten the locales particularly the women on the importance and functions of electricity;[80]

iv. Rural consumers were enlightened on how to use electricity so as to avoid safety hazard;[81]

v. Being a government agency, it received the support of both political parties and is still functional even after fulfilling its mission.[82]

As noted earlier, the US approach for making electricity supply available to the rural farming communities was not a function of off-grid systems but it was achieved through the expansion of the power grid to the rural communities. Strategic policies were made towards sitting power substations close to rural areas and far from urban areas.[83] The closeness of power substations to rural areas was an important determinant of rural electricity access. Proximity to the grid increased the chances of the

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[77] RT Beall, (n 66).
[78] Pellegrini, &Tasciotti, (n 11).
[79] ibid.
[80] ibid.
[81] ibid.
[82] ibid.
[83] J Lewis, & E Severnini, 'Short- and Long-run Impacts of Rural Electrification: Evidence from the Historical Rollout of the U.S. Power Grid. (2017) 4-5. <https: //economics.yale.edu/sites/.../lewis_severnini_rural_electrification_dec2017.pdf> accessed 5 September 2015.

cooperative societies to obtain loans to facilitate power supply to their farms and reduce the cost of electricity services.[84] Electric utilities companies were also supply power to local consumers. In less than two decades, 93 percent of US farms were electrified, and the default rate on loans was less than 1 percent.[85] This figure increased to 95 percent in 1955.[86] Lack of rural access to electricity is now a historical relic in America.

At the moment, the nook and cranny of America is completely electrified. The Rural Electrification Administration appears to have attained redundancy as they had long discharged their duty of total electrification of the local isolated farms. However, the Agency is still in operation. The Act was amended on February 07, 2014. The effect of the amendment has made the Act to be applicable to not just electricity provision for rural agricultural communities but also for other utilities in rural areas such as: rural telephone bank, rural economic development and rural broadband telecommunication access. The Act now confers on the Secretary of Agriculture the powers to give effect to the Act, which was the role hitherto performed by the Administrator.[87] They fund of the agency, known as the Rural Electrification and Telephone Revolving Fund, are obtained from the budgetary appropriations[88] of the US Congress and other sources listed in Section 301 of the Act (as amended). Section 305 provides for the available insured category of electric loans and their prevailing rate.[89]

The amended Act's inclusion of off-grid renewable energy systems as part of the purpose for which the loan may be obtained[90] despite America's well developed grid system suggests a recognition of the relevance of decentralised energy options as a guarantee to reliable and sustainable power sector.

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[84] ibid.
[85] Herscowitz, & Auth, (n 73) 53.
[86] 579Lewis, J. and Severnini, E. 'The Value of Rural Electricity: Evidence from the Rollout of the U.S. Power Grid' (2014) 3 <https://pdfs.semanticscholar .org/8202/a72b497eee7b74d2a7a82022412381d870da.pdf> accessed 5 September 2015.
[87] Section 2 Rural Electrification Act (as amended 2014)
[88] Section 3 Rural Electrification Act (as amended 2014)
[89] These includes: hardship loans, severe hardship loans and extremely high rates.
[90] Section 2 and 4 Rural Electrification Act (as amended 2014)

Micro-grid system is utilised in America as a contingency planning in eventualities of grid failure arising from hurricanes, thunderstorm, cyber-attacks, theft and other factors that may sabotage the grid system. They are mostly used in large facilities such as military bases and industries.[91] These present day realities have realities have made the private sector, states and federal government to start embracing off-grid technologies.[92] There are growing residential, commercial and agricultural needs for off-grid systems in the U.S. which have resulted in high use of solar photovoltaic installations to meet those needs.[93] Agricultural endeavours are well served by renewable energy based off-grid systems due to its many advantages such as: substitute or supplement for grid power, fixed energy cost, low maintenance costs, free source of fuel[94] and environmental friendliness.

5. RURAL ELECTRIFICATION LESSONS FROM AMERICA

At the moment, rural electrification is no longer topical in the U.S. This is because the country had long achieved total electrification of its entire geographical space. However, the relic of the past still exists as the American Rural Electrification Administration is still in operation despite having outlived its essence. Moreover, the lessons from their experience are still ever green. The American part to rural electrification was through grid expansion to rural area and farming communities. The objective was purported at the improvement of the socio-economic welfare of the rural dwellers who needed power supply to improve on their agrarian endeavours. Unlike the

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[91] U.S. Department of Energy. 'United States Electricity Industry Primer' (2015) 34 <https://www.energy.gov/sites/prod/files/.../united-states-electricity-industry-primer.pdf> accessed 5 September 2018.

[92] TF McLarty, & TJ Ridge, 'Securing the U.S. Electrical Grid: Understanding the Threats to the Most Critical of Critical Infrastructure, while Securing a Changing Grid' (Center for the Study of the Presidency & Congress Report 2014) 155 <https://www.thepresidency.org/sites/default/files/Final%20Grid%20Report_0.pdf > accessed 5 September 2018).

[93] IM Xiarchos, & B Vick, 'Solar Energy Use in U.S. Agriculture – Overview and Policy Issues' (U.S. Department of Agriculture Report 2011). 13.<https://www.usda.gov/oce/reports/energy/Web_SolarEnergy_combined.pdf>accessed5September 2018.

[94] ibid.

Nigerian approach, the Rural Electrification Administration is not a project execution agency. It served as loan and funding facilitation agency to certain stakeholders for the purpose of developing and executing rural electrification projects. This approach allowed various group of persons who have interest in rural electrification to get involved and participate in the ensuring access to power supply. This explains why the rural farmers who are directly affected by the lack of access to power supply were the most forthcoming in accessing the loans to solve their peculiar challenge. This is the advantage of establishing a rural electrification strategy that allows the local people to participate in the programmes of the system.

The rural electrification strategy of Nigeria is highly centralised. It had been herein argued that the business of rural electrification rightly inheres in the state and local government authorities. The federal government can continue to play the role of funding while allows the state governments, local governments, and private investors to do the execution of rural electrification programmes. Since 1981 the Rural Electrification programme was first launched in Nigeria, it had always been under federal government administration yet no positive result had been achieved. Thirty seven years is a long enough time to realise that the use of centralised system to solve localised problems would not achieve result. Nigeria should adopt the community-driven model of the U.S. rural electrification.[95]

The American approach of rural electrification was the expansion of the transmission grid network towards rural area making it easy and attractive for private investors and the rural dwellers to access loans to connect their farms to the electricity grid. This approached paid off for them. The reasons are not far-fetched. The country had already established a formidable grid distribution strategy using the decentralised approach. Each State was actively developing its grid. Also, the legal framework made it possible for persons other than the federal government to get involved in electricity transmission.

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[95] Herscowitz, & Auth, (n 73).

In the case of Nigeria, rural electrification may not be achieved through the national grid expansion or it may take a longer time to do so judging by the current legal regime and practice in Nigeria. The initial strategy of the rural electrification in Nigeria was transmission grid expansion to the rural areas. This approached failed woefully as over three decade hence no positive result had been attained. Transmission grid development and management is the exclusive preserve of the federal government. Hence, other stakeholders would not enjoy the legal and federal government support in engaging in such undertaking unlike the American situation. The national grid transmission network does not even have the capacity to wheel the generated power the various sub-stations across the country. In view of the foregoing, the American example is not suitable for Nigeria in this regard. The best bet which makes room for a multi-faceted approach to rural electrification is the utilisation of decentralised off-grid system. On the authority of the Constitution, even state government can get involved in off-grid system development.

6. INDIAN RURAL ELECTRIFICATION STRATEGY

Despite the fact that more than 75 percent of Indian population enjoy access to grid-electricity, in view of the country's huge population size, this leaves over 300 million Indians without electricity or dependent on traditional and unclean sources of energy.[96] The Indian national census of 2011 shows that 81 million households equivalent to about 400 million people, 90% of whom are rural dwellers lack access to electricity supply.[97] This is notwithstanding the 5.1% of power deficit and 2% peak deficit actuated by recurrent power failure experienced by persons who are under-served by grid supply.[98] In his August 15, 2015 Independence Day address, the Indian Prime Minister gave assurances of the government's solemn commitment to

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[96] T Adams, 'Measuring the Impact of Solar Energy in Rural India', in H Schützeichel, (ed), Off-Grid-Industry Yearbook (Sun-Connect News 2018) 255, 255.

[97] R Goyal, & M Wiemann, 'The India Off-grid Electricity Market: Policy Framework, Players and Business Opportunities' (European Business and Technology Centre Report 2015) 7 <thecleannetwork.org/.../the-india-off-grid electricity-market-ebtc-are-report.pdf> accessed 3 August 2018.

[98] ibid.

ensure that the 18,452 villages without access to electricity would be electrified in less than 1,000 days.[99] By March 2017, more than 3/4th of the villages have been electrified while the arrangements are in the pipeline to ensure that the left-over fraction of communities are have access to electricity before the end of the deadline.[100] In March, 2016, the Government launched its total electrification for every household in 2019 target, by the use of grid extension schemes for 18,400 villages and towns and off-grid technology for about 3,500 interior villages.[101]

India is the foremost country to have created a government ministry dedicated to the development of renewable energy especially for off-grid rural electrification. The first Indian Five-Year Plan in 1950 set the groundwork for rural electrification policy, which was concerned with the socio-economic perspective of rural development.[102] The institutional started out as the Commission for Additional Sources of Energy in 1981 leading to the creation of the Department of Non-conventional Energy Sources (DNES) in 1982.[103] In 1992 it transformed to the Ministry of Non-conventional Energy Sources (MNES) and finally became the Ministry of New and Renewable Energy (MNRE) in 1996.[104] In line with its five years plan of building 10,000 micro- and mini-grid powered by renewables throughout the country, the National Tariff Policy (NTP) and Draft Mini-Grid Policy were established in 2016 to set the groundwork for the take-off of these projects.[105]This line of development expresses a paradigm shift from the subsidiary role

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[99] A Chandorkar, 'Electricity for All and the Mantra of Source Agnosticism' in H Schützeichel, (ed), Off-Grid-Industry Yearbook (Sun-Connect News 2018) 29, 29.

[100] ibid.

[101] Dalberg Global Development Advisors, 'Improving Access to Electricity through Decentralised Renewable Energy: Policy Analysis from India, Nigeria, Senegal and Uganda' (2017) 12 <https://www.dalberg.com/system/files/2017-07/Dalberg offgrid-policy.pdf> accessed 6 June 2018.

[102] S Samantray, 'Decentralized Renewable Energy: Complementing the Grid to Rea ch Millions without Access in India' H Schützeichel, (ed), Off-Grid-Industry Yearbook (Sun-Connect News 2018) 251, 252.

[103] TT Onifade, 'Legal and Institutional Framework for Promoting Environmental Sustainability in Nigeria through Renewable Energy: Possible Lessons from Brazil, China and India' (LLM thesis, University of Ibadan 2014) 184-185.

[104] ibid.

[105] Dalberg Global Development Advisors (n 101).

to a more prominent role for mini-grids as the way to go towards the attainment of rural electrification.[106] Rural electrification has ever been on the increase as so many villages are connected to one distribution grid or the other. Off-grid rural electricity continually face the challenge actuated by the uncertainty that trails future government grid extension plans which has made developers the systems to exercise due caution and restraints as they doubt the long-term viability of their investment.[107] However, recent developments in government policy formulations have given tacit approval for the concurrent operation of mini-grid systems in areas that are under-served by the main grid.[108] Specifically, Rajasthan and Uttar Pradesh States have exemplified this with the creation of policies that demonstrated mean by which micro-grids can work *pari passu* with the main grid system.[109] But then again, the off-grid system would still have to face stiff competition with grid-electricity which often enjoys government subsidies.[110]

The Electricity Act 2003 empowers the Central Government to formulate national policy in favour of rural electrification by stand-alone systems powered by renewable energy and other non-conventional sources of energy, upon due consultation with the State Governments.[111] Upon due consultation with the State Governments and State Commissions, the Central Government is also to make national policy towards rural electrification, local distribution and bulk purchase of power in rural areas through 'Panchayat Institutions, users' associations, cooperative societies, non-Governmental organisations or franchisees'.[112] The States and Central Governments have common and equal responsibility of promoting rural

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[106] Okapi Research and Advisory. 'Beyond Off-grid: Integrating Mini-grids with India's Evolving Electricity System' 23 <okapia.co/.../1439780407Integrating %20Mini%20Grids%20with%20India's%20Evolving%20Electricity%20System \ %20(May%2026, %202017).pdf> accessed 3 August 2018.

[107] The Climate Group. 'The Business Case for Off-grid Energy in India' (2014) 40 <https://www.theclimategroup.org/.../The-business-case-for-offgrid-energy-in In dia.pdf> accessed 3 August 2018.

[108] Okapi Research and Advisory (n 106).

[109] K Singh, 'Of Sun Gods and Solar Energy in India' in H Schützeichel, (ed), Off-Grid-Industry Yearbook (Sun-Connect News 2018) 230, 230.

[110] The Climate Group (n 107)

[111] Section 4 Electricity Act 2003.

[112] Section 5 Electricity Act 2003.

electrification across villages, hamlets and individual households.[113] Off-grid systems based on hybrid renewable energy offer a viable substitute to grid extension given their sustainability quality, techno-economic viability and environmental friendliness.[114]

State incursion into mini-grid regulations garnered momentum in 2016 when the Uttar Pradesh New & Renewable Energy Development Agency (UPNEDA) and the Uttar Pradesh Electricity Regulatory Commission (UPERC) started providing support for mini-grid development at the state level. Jammu & Kashmir State Electricity Regulatory Commission (JKSERC) and Bihar Electricity Regulatory Commission (BERC) follow suit with Draft Mini-grid Regulations. The Ministry of New and Renewable Energy (MNRE) took the hint which prompted it to publish a draft National Mini-grid Policy which formed a template for states to build on.[115]

Mini-grid rural electrification is mostly undertaken by private sector investors. The Indian method of encouraging rural electrification is to exempt licence requirements for persons who wish to engage in rural electrification provided the operator notifies the authority of the areas within the contemplation of the project and complies with such terms and conditions issued by the regulator, particularly the safety standards contained in Section 53 of the Electricity Act.[116] The regulators also refrain from making interference on the tariff operators charge the local communities for their services.[117]

Some schemes have been formulated to generate financing for the development of renewable energy based off-grid systems. The National Clean Energy Fund was established in 2011 to finance research and development of renewable energy

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[113] Section 6 Electricity Act 2003.

[114] R Sen, and SC Bhattacharyya, 'Off-grid Electricity Generation with Renewable Energy Technologies in India: An Application of HOMER', (2014) 62 Renewable Energy 388, 388.

[115] Okapi Research and Advisory (n 107).

[116] See Proviso 8 to Section 14 Electricity Act 2003.

[117] SC Bhattacharyya, 'To Regulate or not to Regulate Off-grid Electricity Access in Developing Countries', 2013 (10) EnergyPolicy 17 <https://www.dmu.ac.uk/documents/...documents/.../pj9--to-regulate-or-not-to-regulate-off-grid---energy-policy.pdf> accessed 6 June 2018.

projects.[118] The fund was derived from taxes imposed on coal production which grow into a pool of fund available as loans to investors in the public and private sector to finance about 40% of the outlay of such projects.[119] The tax on coal was raised in 2014 by 100% which is US$1.50 for the production of each metric ton of coal.[120] This implies an increase of the National Clean Energy Fund. In 2015 at the sum of US$4.6 billion, the country had a remarkable experience of 75% upsurge in large scale solar financings compared to the record of the preceding year, even though this was lower than the US$4.9 billion recorded for the year 2011.[121]

The countries special interest in renewable energy is demonstrated in the enactment of the Renewable Energy Act in 2015. India's aggressive investment in off-grid renewable energy for the purpose of rural electrification has really paid off with the achievement of several milestones. The special emphasis on solar technology has given the country a comparative advantage and edge in this area of renewable energy development. The United Nations Environmental Programme Report captures this success story thus:

Among the big projects getting the financial go-ahead were the NTPC Kadiri PV plant phase one, at 250MW, and the Adani Ramanathapuram PV installation, at 200MW. Capital costs for PV projects in India have fallen to among the cheapest in the world, at around $1.1 million per MW, and in January 2016, an auction in Rajasthan for 420MW of capacity produced winners at tariffs of just six US cents per kWh. The country has a 2022 solar target of 100GW, equivalent to some 12GW per year, far above its 2015 installation level of around 3GW. It is pursuing this target via auctions. In wind, the $4.1 billion of asset finance in 2015 was 17% up on the previous year but below the $5 billion-plus figures of 2010 and 2011. One of the largest projects financed was the Hero Andhra Pradesh project, at 150MW, but

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[118] The Climate Group (n 107) 57.
[119] ibid.
[120] ibid.
[121] United Nations Environmental Programme, 'Global Trends in Renewable Energy Investment' (2016) 27 <https://www.scribd.com/.../globaltrendsinrenewable energyinvestment2016lowres-0-pdf> accessed 19 September 2019.

there were a sizeable number of others both sides of the 100MW mark.[122]

Beaming with confident strides of their achievement in this regard, the India government had in the Conference of Parties to the Paris Agreement on climate Change held in November 2015 made commitment to raise the use of non-fossil-fuel in the country's energy mix from the present level of 30% to 40% in 2030.[123]

7. RURAL ELECTRIFICATION LESSONS FROM INDIA

Decentralised system for rural electrification has been a key factor in the rapid increase in access to electricity. The Indian system is all inclusive in approach. Inclusiveness guarantees the participation of each community and ensures that their concerns and interests are addressed in the development agenda.[124] The Central government is responsible for policy formulation for rural electrification. However, there is wide spread consultation of various stakeholders, particularly the government of each state before such policies are made. The state governments are responsible for the implementation of the rural electrification policies. The Indian system also recognised the roles of the communities, corporative societies etc. in the development of rural electrification. This is unlike the centralised system in Nigeria where rural electrification is coordinated and implemented at the federal government level via the Rural Electrification Agency. Nigeria can take a cue from India in this regard. A decentralised rural electrification system where states are given prominent role to play would enable easy understanding and satisfaction of the energy needs of the people.

The Indian experience has also demonstrated that off-grid renewable sourced energy is the best option for rural electrification. The question of huge cost for renewable energy

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[122] ibid.
[123] ibid. 71.
[124] C Kuruvilla & K Sathyamurthy, 'Community Participation Towards Effective Social Work Practice', (2015) 5 (12) IndianJournal of Applied Research 16, 17.

is no longer attainable as technological advancement has reduced the cost of renewable off-grid energy to bring it at par and even below the cost of grid extension especially to interior areas. More efforts should be made to develop off-grid technology along the line of renewable. Rather than the government subsidies available for the use of fossil fuel, this could be channelled to encourage renewable energy development, especially for rural areas.

India has come to the realisation that mini-grids systems and the national grid are not contenders but partners in progress towards realising access to reliable electricity for the people. This informs the aggressive development of off-grid programmes based on renewable energy, especially solar technology, in the last decade. This informs the 'free hands' which the government have given to companies and investors that wish to operate renewable energy powered off-grid platforms in rural areas. This is in contrast with the purported 'light handed' regulatory approach which the Nigerian system had adopted. By so doing NERC made regulations that requires permit and other conditionalities such as tariff regulations before certain off-grid endeavours can be undertaken. This situation has defeated the essence of the free hand which the EPSRA intended to give certain off-grid undertakings. The Indian 'free hand' approach is partly responsible for their success story in rural electrification as investors and consumers are at liberty to exercise their freedom of contract in accordance with their best interest.

8. CONCLUSION

Nigeria has always had challenge with providing adequate and efficient power supply. Part of the challenges has been on the countries reliance on the expansion of the national grid network to meet the electricity need of the country's massive population and large land mass. Rural dwellers feel the major brunt of inadequate power supply due to complex geographic and topographic limitations to access to the national grid network. Virtually all Nigerian who lack access to electricity are rural dwellers. The universal electrification objectives embodied in the Sustainable Energy for All programmes seeks different approach to rural electrification other than grid extension to

unserved areas with scanty populations. Off-grid electricity powered by renewable energy sources would be most useful and suitable for rural dwellers that are unserved or underserved by grid connection. Hence, off-grid electricity, is at the heart of rural electrification. The need for aggressive rural electrification also becomes obvious in view of its potential to aid economic growth, particularly for small and medium scale business owners and help lift rural dwellers off the poverty line.[125]

This paper, therefore, examined the challenges with development of rural electrification in Nigeria. It also examined the American and Indian model of rural electrification. A juxtaposition of the Nigeria rural electrification legal framework with that of its American and Indian counterpart shows that there are various lessons that could be applied to the Nigerian situation. Finding shows that Nigeria uses the centralised approach to rural electrification. The weakness of this approach is that, it uses a uniform system that does not take cognisance specific needs and energy solutions that is compatible with the peculiarities of each locality.[126]Hence, a decentralised approach rural electricity is preferred. This approach has worked well for India.

The EPSRA aims at entrenching private sector involvement in the power sector. Notwithstanding the gains of privatisation of the electricity industry, it portends negative impact on rural electrification. The sole aim of private enterprise is profit making. In a bid to attain that aim in the satisfaction yearnings of the shareholders of the business enterprise, private electricity undertakings and investors may on logistic or economic grounds avoid making supplies to rural settlements which are far-flung from grid networks, have low consumption or power purchase ability.[127] Hence, there is need for more government support in conjunction with private sector engagement, in order to ensure sustainable rural electrification.

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[125] PK Oniemola & OC Tasie, 'Incorporating Off-grid Renewable Energy Options under the Framework for Rural Electrification in Nigeria', (2016) 34 (8) International Energy Law Review 327, 328.

[126] S Feron, 'Sustainability of Off-grid Photovoltaic Systems for Rural Electrification in Developing Countries: A Review', (2016) 8 (12) Sustainability 1326, 1331.

[127] SO Oyedepo, 'Energy and Sustainable Development in Nigeria: The Way Forward',(2012)2 (15)Energy, Sustainability and Society1, 3-4.