Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

OVERCOMING THE ENERGY CRISIS IN NIGERIA: HAS THE POWER SECTOR REFORM IMPROVED ELECTRICITY GENERATION IN NIGERIA, 2013-2023

Anthony Chinonso Ajah, Hillary Obike and Okorie Albert, Ph.D
Department of Political Science, University of Nigeria, Nsukka
Department of Government and Public Administration, Abia State University , Uturu
Department of Political Science, University of Nigeria, Nsukka

Abstract: The paper argues that the privatisation of the power generation companies has enhanced electricity generation in Nigeria and that integration of independent power producers into the national grid ameliorated the challenges of electricity generation in Nigeria. The study adopted the theory of economic liberalism to advocate support for a free-market economy and the liberalisation of power generation, transmission and distribution in Nigeria. Documentary method was used for data collection and content analysis for the interpretation of data generated in course of the study .Investigation revealed that privatisation of power generation companies has significantly increased electricity generation in Nigeria from 3000MW in 2013 to about 8100MW daily in 2021. It also discovered that government ownership and management of electricity transmission, as well as frequent national grid collapse, have resulted in massive power losses and unevacuated electricity. On the strength of this findings, the study recommended that the Transmission Company of Nigeria (TCN) which is 100% owned by the government should be privatised to accommodate private sector investment and expansion of the transmission infrastructure to enable the evacuation of more electricity from the generation plants to the national grid.

Keywords: Power sector Reform, Electricity Generation, Generation Companies, Transmission Company of Nigeria, Nigeria Bulk Electricity Trading Company

Introduction

It is incontrovertible that electricity energy is one of the most critical infrastructures needed to propel industrialisation and overall economic growth and development of a nation (Wakeel, 2019). However, over the past 50 years electricity generation, transmission and distribution in Nigeria have remained unstable, erratic and unreliable (Muogbo, 2013). Historically, electricity generation in Nigeria dates back to 1896 when the colonial government installed the first two power generation plants in Lagos (NERC, 2010). This was followed by the 2-megawatt (MW) power plant built around the Kwali River in 1923 by the Tin Miners of Nigeria (Emodi & Dauda, 2015). In 1929, the Nigerian Electricity Supply Company, a private company in Jos , was formed to manage a hydroelectric power plant at Kura and to supply electricity to the mining industry (Awosope, 2014). In 1930, the Sapele power plant owned by African Timber and Plywood Limited became operational (Johnson, 2019).By 1950, the colonial government created the Electricity Corporation of Nigeria (ECN) to serve government reservation areas (GRAs) and commercial centres (Aliyu, 2017).

Shortly after independence in 1960, the Niger Dam Authority (NDA) was formed to build and maintain dams along the River Niger and Kaduna River. The NDA went on to build hydroelectric power plants such as the 320MW capacity Kainji dam in 1969 (NERC, 2020). In 1972, the NDA and ECN merged to form the National Electric Power Authority (NEPA) (NERC, 2010; Emodi&Dauda, 2015). NEPA, a vertically integrated utility company mandated by Decree No. 4 to provide a stable, coordinated, and reliable system of electricity supply to all parts of Nigeria operated 3 major hydro and

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

4 thermal power plants (Aminu and Peterside, 2014; NERC, 2010).The thermal power plants include Sapele Power Station, which was built between 1978 and 1981, Ughelli Power Station, which was built between 1966 and 1990, Egbin Thermal Power Station, which was built between 1985 and 1986, and Afam IV–V Power Station, which was built between 1982 and 2002. Hydropower plants include Kainji and Jebba Power Stations in Niger State, which were built in 1969 and 1985, respectively, and Shiroro Power Station in Kaduna, which was built in 1990 (Aminu and Peterside, 2014; Onochie, Egware, and Eyakwanor, 2015).

However, despite an estimated 6, 800 megawatts installed capacity , electricity generation, transmission and distribution by NEPA in Nigeria between 1972 and 2005 remained low and failed to meet the nation's electricity needs (Hashim, 2017; Muogbo, 2013). In fact, there was a gulf between the total installed capacity and the actual generation capacity (Babatunde and Shauibu, 2011). These challenges prompted the power sector reforms starting with the promulgation of the National Electric Power Policy in 2001 and the establishment of the National Integrated Power Projects (NIPP) to remedy the power shortage situation (NERC, 2020; Hashim, 2017; Muogbo, 2013; Aminu, and Peterside, 2014). In 2005, the Electric Power Sector Reform (EPSR) Act, which gave legal backing for the unbundling of the NEPA into 6 generations, 11 distributions, and the transmission company of Nigeria, was passed into law (Albert et al., 2021). In September 2013, the successor companies, generation and distribution companies (GenCos and DisCos) were privatised, completing the long process of power sector reform (Hashim, 2017; Muogbo, 2013; Francis et al., 2019; Amadi, 2018).

To encourage the necessary private sector investments, the government implemented incentives such as the unrestricted market entry of competent operators both within and outside the country and the licensing/integration of new Independent Power Producers (IPPs) into the pool of electricity generation in Nigeria (RPSR, 2010; Wakeel, 2019; Aliyu, 2017; Johnson, 2019). It also includes long-term concession of the power plants to core investors who demonstrate the technical and financial ability to operate and expand each plant; licensing and engaging companies that have installed capacities, including the international oil companies, to encourage them to expand their power production capacities and sell electricity to the national grid (Emodi, &Dauda, 2015; Francis, et al, 2019).

Existing analyses on the post power sector reforms in Nigeria have attracted plethora of literature. has explored and analysed the impact of the reform on electricity distribution and transmission (Adoghe, Odigwe, Igbinovia, 2009; PWC, 2016; Onagoruwa, 2018; Olaoye, et al., 2016).

It assessed the performance of the power sector in the post-privatisation era and highlights the challenges confronting electricity generation in Nigeria (Ezirim, Eke, and Onuoha, 2016; Awosope, 2014; Enoche, et al., 2015). Extant studies also explored the underlined politics behind the reform and its implications for the power sector (Albert, et al., 2021; Johnson, 2019; Onochie, et al., 2015; Amadi, 2018). Within this group, Albert et al. (2021) viewed the reform through the prism of crony capitalism, arguing that the privatisation and concession of the GenCos and DisCos were nothing more than political clientelism, patronage, and ceding of national infrastructure to political cronies of the then ruling party, the People's Democratic Party (PDP). They argue thus:

Also, Aminu and Peterside (2014), anchoring on the propositions of the Marxian theory of the state, contend that the reform represents a strategy by the indigenous capitalist class in Nigeria (who are also the ruling and governing class) in collaboration with their foreign collaborators to increase their control of the means of production by dominating the ownership of electricity generation and distribution infrastructures in Nigeria (Hashim, 2017; Aminu, and Peterside, 2014).

However, while extant literature has explored the impact of the reform on electricity transmission and distribution as well as the challenges and the politics of the power sector reforms, it has glossed over its impact on electricity generation. Therefore, against this background, this study critically assesses the impact of power sector reform on electricity generation in Nigeria between 2013 and 2022

Theoretical Framework

The study is anchored on the theory of Economic Liberalism which is based on strong support for a free-

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

market economy and private ownership and control of the means of production. It is an economic and political orientation which advocates limited government intervention in the economy. Arguments in favour of economic liberalism were advanced during the Enlightenment, opposing mercantilismand feudalism. It was first outlined by Adam Smith in his book "An Inquiry into the Nature and Causes of the Wealth of Nations" (1776).

Economic liberalism is founded on the principles of private property and individual contracts (agreements). According to the early theorists, individuals' economic actions are primarily motivated by self-interest (the invisible hand), and allowing them to act without restriction will produce the best results for everyone (spontaneous order), provided that at least minimum standards of public information and justice are in place (regulations). It believes in a natural harmony of interests where producers provide us with goods, not out of concern for our well-being, but due to their desire to make a profit. Likewise, workers sell their labour and buy the producer's goods as a means of satisfying their wants. By individuals pursuing their interests, the best interests of society are served (Smith, 1776).

To liberal economists, the forces of a free competitive market economy should guide production, exchange, and distribution in a manner that no government could improve upon. The government's role, therefore, is limited to the protection of property rights, the enforcement of contracts providing public goods, and maintaining internal and external security. Thus, the role of the government should be that of a regulatory institution that checks the excesses of the activities of private entities. A non-restrictive but regulatory government ensures free entry and exit in the market, exchange relations, and property accumulation premised on efficiency and profit maximization (Aja, 1998). As noted by Muogbo (2013), the theory of economic liberalism is also anchored on the benefits of a free-market economic system, especially efficient service, effectiveness and productivity alongside deregulation or liberalization of the operating environment.

In the thesis of economic liberalism, free trade, deregulation of the economy, lower taxes, privatization, labour market flexibility, and opposition to trade unions are also common positions. It opposes nationalisation and advocates the privatisation of public enterprises by transferring state-owned assets to the private sector control and lifting restrictions surrounding private investment in public enterprises. The core assumptions of the theory are as follows:

- Free market economy and private ownership and control of the means of production
- Government should assume a regulatory role by establishing institutions that check the excesses of the activities of private entities
- Privatisation of Public enterprises
- Free-market entry and exit
- Effectiveness and productivity alongside deregulation or liberalization of the operating environment

Economic liberalism is a political as well as an economic analysis that assumes that the productivity and efficiency of economic enterprises such as the Power Sector would perform much better in a free and competitive market economy. In this free market economy, it argues that government should hand off the production, and transfer the ownership of production and distribution of services to the private sector. Thus, the role of government, therefore, is limited to the protection of property rights, the enforcement of contracts providing public goods, and checkmating the excesses of the activities of private entities through institutional regulations.

This theoretical thesis, thus, motivated a global economic reform that found its way into Africa in the mid-1980s. In Nigeria, the liberal economic order influenced the first-ever economic reform, the Structural Adjustment Program (SAP) 1986, which privatised and commercialised numerous government own enterprises beginning in 1988 (NEPA was also commercialised within this period) (Akinola, 2021). It was also in this order that the federal government of Nigeria enacted the public enterprises (privatization and commercialization) Act of 1999, which established the National Council on privatisation and the Bureau of Public Enterprises (BPE).

In the power sector, the adoption of economic liberalism influenced the power sector reform starting with the promulgation of the National Electricity Power Policy of 2001 and the Electric Power Sector Reform Act of 2005,

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

which provided the statutory basis for the unbundling of the Power Holding Company of Nigeria into 11 distribution companies, 1 transmission company and 6 generation companies.

The reform process was divided into two main stages: the unbundling of NEPA into segments; the transfer of assets to the Power Holding Company of Nigeria (PHCN); and the sale of assets to private companies. In the first stage, NEPA was unbundled into generation, transmission and distribution segments, comprising eighteen new successor companies under PHCN in November 2005. Specifically, six companies handled power generation; a single subsidiary (Transmission Company of Nigeria) controlled the transmission segment, while eleven companies managed the distribution of electricity within designated geographical areas. Nigerian Electricity Liability Management Company (NELMCO) was established to oversee the transition and liability management in the transfer of the assets, liabilities and staff of PHCN to the successor companies. In 2010, the Nigeria Bulk Electricity Trading Co Plc. (NBET) was incorporated and charged with the role of bulk trading, while NERC was established to act as an independent regulator of the power sector.

In December 2010, the FGN requested investors to submit their bids. In 2013, the Bureau of Public Enterprises (BPE) held a bid round to auction at least 51 percent ownership of four thermal generation plants, two hydropower generation plants, and eleven distribution companies held by the defunct PHCN. Out of 330 Expressions of Interest, 220 bidders were selected and, ultimately, 15 enterprises won the bids. By the end of 2014, the government was able to completely hand over the power generation and distribution assets to private hands (FGN, 2016).

To create free-market enterprises and remove restrictions surrounding power generation and distribution, the government also issued licences to independent power producers (IPPs) and core investors who demonstrate the capacity, technical knowledge and investment ability to build and maintain power generation plants in Nigeria. Incentives were also created to attract core investors with large expertise and liquidity to finance the infrastructure needed to improve power generation and distribution in Nigeria.

In conclusion, the theory of economic liberalism best explains this study because it highlights the economic and political rationale behind economic reforms in Nigeria which saw the privatisation of the power sector as a means of ensuring a free competitive market economy, attracting investors to the power sector, and ensuring increased productivity and efficiency after decades of NEPA mismanagement.

Methodology

The study adopted documentary methods for data collection and content analysis for the interpretation of data generated in course of the study. Documentary method involves eliciting information from already existing documents. Contents analysis enables us gather, investigate, categorize, interpret and identify the usefulness or otherwise of documents consulted as sources of data in the study. In line with the above, the study essentially relied on and utilized relevant data from official report documents from the Nigeria Bulk Electricity Trading Company (NBET), the Nigeria Electricity System Operator (SO), the Association of Power Generation Companies of Nigeria (APGC),and the Transmission Company of Nigeria (TCN), Power Africa- Nigeria Power Sector Program (PA-NPSP), and Guardian Newspaper online report, among others. Also, information was gotten from journals and other materials.

Privatization of Power generation companies and Electricity Generation in Nigeria

As part of the capitalist orientation and neo-liberal reforms which swept across Sub-Sahara Africa in the mid-1980s, most countries in the region including Nigeria began to initiate and implement structural changes in different facet of their economy. Thus, the role of the public sector in owning and managing economic assets was reduced. Policies such as privatisation, deregulation and commercialisation were encouraged based on the assumption that market forces would allocate resources more efficiently. Within this period, the defunct NEPA was commercialised.

However, following the failure of NEPA to maintain and manage electricity generation, transmission and distribution; coupled with years of erratic power supply-despite huge government investment, the power sector was privatised. In 2013, after the enactment of the

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Electric Power Sector Reform Act (EPSRA) in 2005, PHCN was unbundled into 18 companies consisting of six (6) generation companies, eleven (11) distribution companies and one (1) transmission company. The EPSRA provided the legal framework that enabled the participation of privately owned enterprises in the Nigerian power sector. In 2013, the majority of shares (and in a few cases, all of the shares) in the six-generation companies were sold to private entities. Also, the majority of shares in the distribution companies were successfully sold to private entities. However, the government retained ownership of the Transmission Company of Nigeria.

The Generation Companies (GenCos)

Electricity supplied to the national grid is produced from two major sources: gas and hydropower plants. While gas (thermal) accounts for about 85.5% of Nigeria's total energy mix, hydro accounts for the other 14.5%. Since 2013, Power generation in Nigeria has remained operational as separate entities following the handover of PHCN assets to the private sector. Today, there are several power generation companies in Nigeria. They are often referred to as GenCos, a term that came into use in 2013. Among these power generation companies are successor companies of the privatised power plants, Independent Power Producers (IPP), and Niger Delta Power Holding Company (NDPHC) also known as the national integrated power project (NIPP). The IPPs include power generation companies managed by the private sector before the privatization of the power generating sector.

Table 1: List of Electricity Generation Infrastructures in Nigeria and their Location

Power Station	Location	Installed Capacity	Year started	functional
AES Barge	Egbin	270 MW	2001	functional
Aba	Aba, Abia State	140 MW	2012	not functional
Afam IV-V Afam,	Rivers State	726 MW	1982	Functional
Afam VI Afam	Rivers State	624 MW	2009	not functional
Geregu 1 Geregu,	Kogi State	414 MW	2007	not functional
Okpai	Okpai	480 MW	2005	not functional
Egbin	Egbin	1320 MW	1986	Functional
Olorunsogo	Olorunsogo	336 MW	2007	Functional
Olorunsogo 11	Olorunsogo	675 MW	2012	not functional
Omoku	Omoku	150 MW	2005	Functional
Omotosho 1	Omotosho	336 MW	2005	Functional
Sapele	Sapele	1020 MW	1981	Functional
Ughelli	Delta State	900 MW	1990	Functional
Jebba	Niger	540MW	1985	functional
Shiroro	Kaduna State	600MW	1990	Functional

Source: ICRC, 2020

Table 1 shows the list of electricity-generating infrastructures in Nigeria. Among these, only a few plants such as Shiroro, Jebba,Afam, Olorunsogo, Ughelli, Egbin, and Sapele were considered functional, contributing about 98% of the overall electricity generation prior to the 2013 privatisation of the GenCos in Nigeria.

Table 2: List of the Privatised GenCos, their new status and ownership

Power Plants	Installed Capacity	Type	Status	New Owner/ Concessioned to
Ughelli Power Plc	972MW	Gas	100% Sold	Transcorp Power Limited
Egbin Power Plc	1,320MW	Gas	80% Sold	Sahara Power Group And KEPCO Energy Resource

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Geregu power Plc	414MW	Gas	80% Sold	Amperion Power Distribution Ltd
Sapele Power Plc	1,020 MW	Gas	51% Sold	Eurafric Power Ltd
Kainji Power Plant	760MW	Hydro	Concession	Mainstream Energy
Jebba Power Plant	578MW	Hydro	Concession	Mainstream Energy
Shiroro Power Plc	600MW	Hydro	Concession	North-South Power Company Ltd
Afam Power Plc	966MW	Gas	100% Sold in the year 2020	Transcorp Power Limited

Source: Compiled by the authors, data generated from https://nerc.gov.ng/index.php/home/nesi/403-generation

Table 2 shows the privatised power generation plants, installed capacity and new companies that acquired them. In November 2013, during the privatization, Transcorp Plc won the bid for the Federal Government of Nigeria's distressed power generating company, Ughelli Power plant. In November 2015, Transcorp Ughelli Power Limited and Ughelli Power Plc merged, and Transcorp Power Limited was born. The merger harmonized the management and operations of Transcorp's power business for greater efficiency. Another notable acquisition is Egbin Power Plant, the largest power generating station in Nigeria with an installed capacity of 1,320 MW consisting of 6 Units of 220MW each. It was acquired in 2013 by Sahara Power Group and South Korean power company, KEPCO Energy Resource. The station is located at Ijede / Egbin, in Ikorodu, Lagos state. Also, Geregu Power Plant was acquired by Amperion Power Distribution Company Limited holding. However, in that acquisition, the company got an 80% stake and the remaining 20% was retained by the Federal Government of Nigeria (jointly held by the Bureau of Public Enterprise and Ministry of Finance Incorporated). Furthermore, the 1,020 MW Sapele power plantswere acquired in 2014 by Eurafric Power Limited. Then, the hydro-powered plants were acquired by Mainstream Energy and North-South Power Company Ltd. It is important to note that not all the six power-generation plants were privatised in 2013. For example, the Sapele power plant was privatised in 2014, while the Afam power plant was not privatised until late 2020 when it was acquired by Transcorp Power Limited.

Nigerian Electricity Regulatory Commission

The 2005 Electric Power Sector Reform Act (EPSRA) established the Nigerian Electricity Regulatory Commission (NERC) which stands as the major regulator of all activities (generation, transmission, distribution, utility, and trading) inthe electricity sector. The commission provides the requirement, regulations, and licencing for investors who wish to participate in the power sector in Nigeria. The commission also establishes subsidiary agencies such as the Rural Electrification Agency which is responsible for promoting rural electrification programmes in the country.

To obtain a generation licence from NERC, an applicant is required to be a company duly registered in Nigeria with audited financial statements and tax clearance certificates for the past three years (this requirement may be waived where the applicant is a newly incorporated Special Purpose Vehicle) (The EPSRA, 2005). Where the proposed generation capacity is 10 MW and above, the applicant is also required to conduct an Environmental Impact Assessment on the location where it intends to carry out the electricity generation. The applicant is also required to provide a power purchase agreement either with the Nigerian Bulk Electricity Trader (NBET) or with another off-taker. Other documents required for the application include evidence of ownership of the project site (or long-term lease agreement), gas supply and transportation agreements (for gas-fired plants), a Water Licence (for hydropower plants), engineering, procurement and construction agreements and operation and maintenance agreements (where applicable), finance agreements and a 10-year business plan. An applicant is required to submit the duly completed application form, together with the required documents and the application fee to the Commission. Thereafter, the Commission will notify the applicant of its decision within 6 months from receipt of the

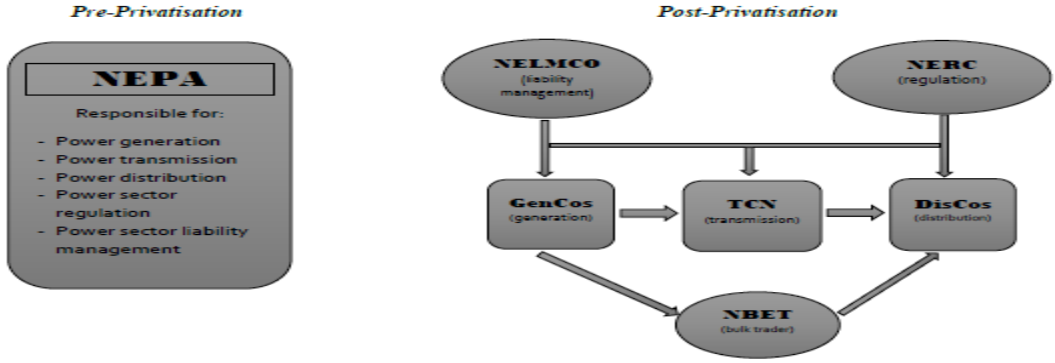
Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

application. Generation licences are valid for an initial period of 10 years, with renewal applicationsexpected at least nine months before the expiration of the initial term (NERC, 2010).

Nigeria Bulk Electricity Trading Company (NBET)

Like the NERC, the Nigeria Bulk Electricity Trading Company (NBET) is 100% owned by the Federal Government of Nigeria. It was incorporated on July 29, 2010, in line with the "Roadmap to Power Sector Reform" and, in fulfilment of the requirements for the Electricity Power Sector Reform Act (EPSRA) of 2005. Its function is to engage in the purchase and resale of electrical power and ancillary services from independent power producers and successor generation companies. NBET purchases electricity from the Generation Companies through Power Purchase Agreements (PPAs) and sells it to the Distribution Companies through Vesting Contracts (ICRC, 2020, NBET, 2020). The Generation Companies include the privatized PHCN successor companies, the Niger Delta Power Holding Companies (NIPPs), the already existing Independent Power Producers (IPPs) and the new IPPs.

Figure 1: Structure of the Nigerian Power Sector before and after privatisation



Source: CSEA, 2017

Figure 1shows an overview of the structure of the Nigerian power sector pre-privatization and post-privatization era. As was already stated throughout this study, the power was vertically integrated under the defunct NEPA and later PHCN. However, following the privatisation in 2013, the Nigeria Electricity Liability Management Company (NELMCo), NERC, GenCos, TCN, DisCos, and NBET became independent electricity companies.

Electricity Generation in Nigeria

Successive governments since independence have struggled to generate enough electricity that would give the Nigerian people access to quality and reliable power supply (Ezirim et al, 2016). In fact, the power supply in Nigeria over the last 50 years has remained unstable, erratic, and unreliable (Albert, et al, 2021).Within this period, the power sector witnessed little infrastructural development and very poor maintenance of the existing infrastructure. From 1972 to 2005, the average electricity generation in Nigeria was nothing more than 1750 MV against an installed capacity of over 5800 MW which by itself was grossly inadequate (ICRC, 2020)

Table 3: Electricity generation in Nigeria from 1975 to 2005

Year	Total generation in Megawatts	Installed capacity in Megawatts
1975	395.4	926.2
1976	468.7	1125.2
1977	538.0	1114.2
1978	522.7	1793.7
1979	710.7	2230.6
1980	815.1	2230.5
1981	887.7	2430.0

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

1982	973.9	2902.1
1983	994.6	2856.8
1984	1025.5	3178.0
1985	1166.8	3995.5
1986	1228.9	4016.0
1987	1286.0	4548.0
1988	1330.4	4548.0
1989	1462.7	4548.0
1990	1536.9	4548.0
1991	1617.2	4548.0
1992	1693.4	4540.0
1993	1655.8	4548.6
1994	1772.9	4548.6
1995	1810.1	4548.6
1996	1854.2	4548.6
1997	1839.8	4548.6
1998	1724.9	4548.6
1999	1859.8	5580.0
2000	1859.8	5580.0
2001	1689.9	6180.0
2002	2237.3	6180.0
2003	1180.0	6130.0
2004	2763.6	6130.0
2005	2779.3	6861.6

Source: Compiled by the authors, data generated from Central Bank of Nigeria Statistical Bulletin 2005

Table 3 shows that the average electricity generation in Nigeria from 1975 to 2005 was below 1750MW. This resulted in an unstable and unreliable electric power supply situation in the country with customers exposed to frequent power cuts and long periods of power outages. Within this period, the power sector was characterised by a lack of maintenance of power infrastructure, outdated power plants, low revenues, high losses, power theft and non-cost reflective tariffs. According to the World Bank survey (2011), about 83% of all managers surveyed considered electricity outages to be a serious problem – more than any other constraint. Firms of all sizes, in all states and sectors, report average power outages equivalent to eight hours per day. By implication, the inability of Nigeria to generate and distribute enough electricity for her teeming population is a key constraint on economic development in the country. As shown in Table 2, there is a gulf gap between the installed capacity and actual generation capacity. Also, within this period, NERC, (2010) reports that only 19 units out of 79 generation units in the country were operational.

Electricity Generation in the Post-Privatisation Era

The failure of NEPA, which was owned and operated by the government, to satisfy the electricity need of the nation, paved the way for the delegation of power generation and distribution functions to the private sector. According to analysts, the biggest success of the Power Sector reform was the successful privatisation of the power sector, the successful financing of the first post-privatisation private sector-funded IPP, and the attractionof over US$5 billion in investments by the private sector. These investments were predominantly driven by confidence in the reform roadmap strategy. Unique to the privatisation exercise was the fact that participation was driven mostly by local sponsors financed by local banks (PSRP, 2017). On taking over the power plants on November 1, 2013, the new

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

investors were expected to refurbish, maintain, replace, operate and expand the capacities of the plants to achieve their mandate of generating electricity for the country. In line with the Power Purchase Agreement (PPA) signed with the BPE, the GENCOs were to recover their cost of investment through invoices from electricity sales.

Performance of the Privatised Power Plants

Statistical evidence shows that the newly privatised generation companies have ramped up power installed capacity from about 7,000MW at taking over on the 1st of November, 2013 to an installed capacity of 13,014MW. More fundamentally, the average daily electricity generation has increased from 3500MW in 2013 to 8,100 MW in 2022

Table 4: Yearly Average Generation/Available Electricity Generated in Nigeria since the Privatisation

Year	Generation/ Available Capacity	Installed Capacity
2022	8,100MW	13,014.14MW
2021	8,100MW	13,014.14MW
2020	7,652.6MW	12,954.40MW
2019	7,652.6MW	12,910.40MW
2018	7,139.60MW	11,165.40MW
2017	7,139.60MW	11,165.40MW
2016	7,492.60MW	11,165.40MW
2015	6,139.60MW	11,165.40MW
2014	6,139.60MW	11,165.40MW
2013	3,030.04MW	7000.20MW

Source: Compiled by the authors, data generated from daily operation report of System Operators of Nigeria, available https://nsong.org/Library.

Table 4 shows that available electricity generated in Nigeria since 2013 has increased year-on-year from 3,030.1MW in 2013 to 8,100MW in 2022, indicating a 381% increment over the past eight years. Also, Nigeria's on-grid installed capacity has equally increased by 96% from 7, 314.20MW in 2013 to 13,014.14MW in the first quarter of 2022.

Table 5: yearly average of electricity sent-out by GenCos, the unutilised/stranded generated electricity, power lost within the same period

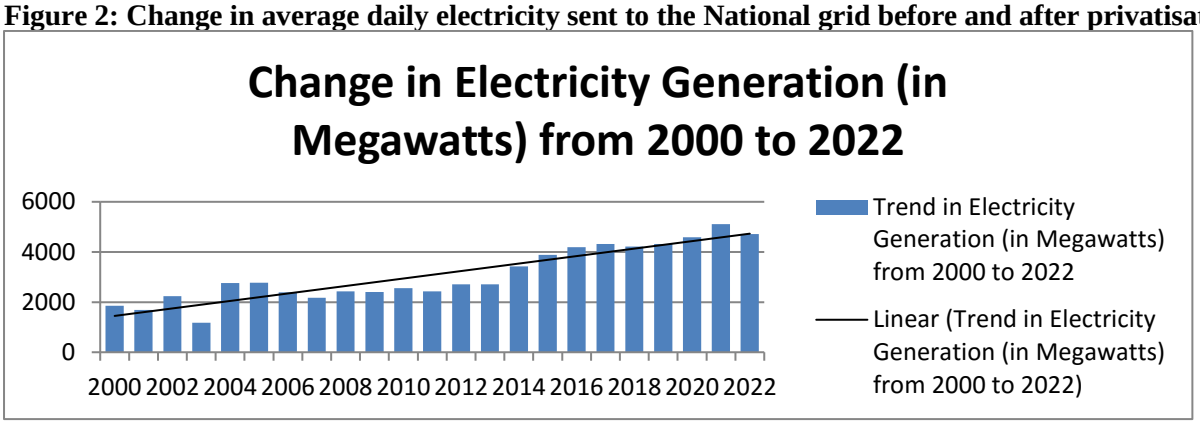
Year	Available Power (Total on-Grid Generation)	Power Sent-Out To The National Grid	Daily Stranded/Unutilised	Daily Power Lost Through Transmission
2021				
1Q	8,100MW	4, 711.30MW	1341.15MW	2, 050.02MW
2Q	8,100MW	4, 882.00MW	1257.58MW	1964.00MW
3Q	8,100MW	5, 110.12MW	1096.44MW	2, 114. 06MW
4Q	8,100MW	5,161.05MW	880.95MW	2, 198.44MW
2020	7,652.6MW	4, 583.08MW	976.76MW	1732.65MW
2019	7,652.6MW	4, 320.11MW	845.00MW	1695.10MW
2018	7,139.60MW	4, 219.22MW	731.98MW	1582.32.MW
2017	7,139.60MW	4,321.01MW	827.08MW	1454.01MW
2016	7,492.60MW	4,184.00MW	719.28MW	1388.20MW
2015	6,139.60MW	3,890.11MW	698.76MW	1365.34MW
2014	6,139.60MW	3,421.19MW	597.21MW	1278.44MW
2013	3,030.04MW	2, 710.01MW	N/A	298.02MW

Source: Compiled by the authors, data generated from System Operators, https://nsong.org/Library.

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Table 5, which was compiled from the Electricity Generation Companies Facts Sheet, shows that while the average available power generation in 2021 was 8,100MW, the actual average generation put on the national grid for utilisation during the period was 4,882.00MW daily. In 2020, 2019, 2018, 2017, 2016, 2015, and 2014, the average power generation capacity stood at 7,652.6MW, 7,139.60MW, 7,492.60MW, and 6,139.60MW respectively, but due to constraints such as stranded/unutilised power, power lost, and other constraints as we shall discuss later in this section, only 4, 583.08MW daily was put on the national grid in 2020, 4, 320.11MW in 2019, 4, 219.22MW in 2018, 4,321.01MW in 2017, 4,184.00MW in 2016, 3,890.11MW in 2015, and 3,421.19MW in 2014. The 2021 generation capacity loss data showed that the country's power sector recorded stranded electricity in all 12 months of 2021, 2020, 2019, 2018, 2017, 2016, 2015, and 2014 respectively.

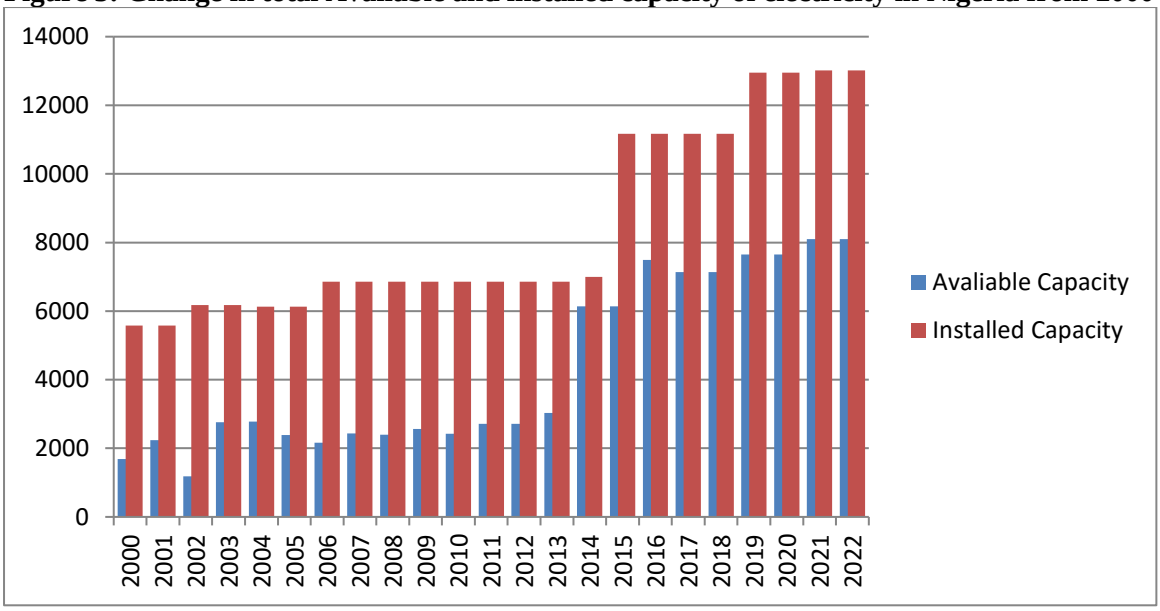
Figure 2: Change in average daily electricity sent to the National grid before and after privatisation



Source: Created by the authors, data generated from https://nsong.org/Library.

Figure 2 shows a continuous trend of increment of daily electricity generation sent to the national grid since. After years of stagnation (200-2013), electricity generation began to witness rapid increase year after year

Figure 3: Change in total Available and installed capacity of electricity in Nigeria from 2000 to 2022



Source: Created by the authors, data generated from system operators of Nigeria https://nsong.org/Library.

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Figure 3 shows rapid increase in both daily available electricity generation capacity and installed generation capacity. From 2013 to 2021, available capacity moved from 3,000MW daily to 8,100MW (i.e. about 291% increases). Also, the generation installed capacity moved from 7000MW in 2013 to 13, 000 in 2021.

Assessment of the Privatised Power plants in Nigeria

As was noted earlier in this section, Ughelli Power Plant, Egbin Power Plant (80% sold), Geregu Power plant, Jebba Hydro power plant and Kainji Hydro power plant were the power generation plants successfully privatised/concessioned in 2013. 51% of Sapele Power plant was sold to the private sector in 2014, while it was late 2020 that the Afam power plant was successfully privatised. Evidence from the Bureau of Public Enterprises (BPE, 2020) shows that Ughelli Power Plant and Geregu power plant have surpassed the five-year performance agreement target of 670 MW and 414MW set by BPE at the handover of Ughelli Power and Egbin Power, after achieving 680.83MW and 435MW daily generation capacity respectively.

Table 6: Power Plants Generation before and after Privatisation

Power Plant	Installed Capacity	Before Privatisation	After Privatisation	Increment (%)	Contribution to the National Grid (%)
Ughelli Power Plant	972MW	160MW	680MW	490%	16%
Egbin Power Plant	1,320MW	300MW	970MW	390%	20%
Geregu Power plant	414MW	30MW	435MW (plant expanded in 2016)	1450%	9%
Sapele Power Plant	1,020 MW	N/A	N/A	N/A	N/A
Kainji/Jebba Power Plant	760MW and 578MW	640MW	1002MW	82%	26%
Shiroro Power Plc	600MW	90MW	390MW	420%	8%

Source: NERC, 2021

According to Shonubi (2021), "Egbin has 1,320MW capacity. But at the time it was taken over, the plant was generating 300MW which is an abysmal 22 percent. As of today, the generation capacity has surged and operating above 89 percent. In fact, the plant hit a generation peak of 970MW in 2021 despite challenges. Also, reports from BPE, NBET, and Transcorp Plc annual report bulletin show that when the Ughelli power plant was acquired by the Transnational Corporation Group in 2013, the plant only had a capacity of 160MW due to an old gas turbine being out of service and other infrastructural issues. The plant, which is now operating with a capacity of 680MW can supply power to up to a 2.4million Nigerian homes.

Furthermore, at handover in 2013, Kainji Hydro Electric with 760MW installed capacity and Jebba Hydro Electric Plant with an installed capacity of 578.4 MW could only boast of 100MW and 45MW generation capacity as 7 of its power generation units were awaiting delayed overhaul. As ofthe present day, the Kainji power plant has increased its available capacity to 440MW and Jebba to 250MW. Also, the 434 MW-capacity Geregu Power plant operated by Amperion Power Distribution Company Limited, a subsidiary of Forte Oil Plc, owned by investor and businessman, Femi Otedola has significantly increased its generation capacity since the privatisation (BPE, 2021).

Constraints to Better Electricity Supply in Nigeria

It is evident from table 3&4 that GenCos are not dispatching at full capacity due to poor utilisation of electricity generated. In her report before the senate committee on privatisation, The Executive Secretary, of

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

the Association of Power Generation Companies of Nigeria, Joy Ogaji, summarized the performance and constraints of the power generation sector in Nigeria thus:

After taking over, Nigeria has increased its ability to generate from 4500 MW to over 13, 000 MW; this is a clear result of the generating companies that have shown their dedication to giving Nigeria the much-deserved electricity by increasing their ability to generate more electricity and present enough to serve Nigeria. With the increase in capacity to produce enough power for the nation, we ask ourselves, so why haven't we seen this newly added capacity? This is because constraining generation capacity occurs frequently in the Nigeria electricity supply industry where generation companies are forced by the Independent System Operator to reduce the amount of power they feed into the electricity grid to maintain system stability, system nominal voltage, nominal frequency and to avoid the overall collapse of the National Electrical Grid. Due to system constraints, GENCOs are forced to reduce generated power to match the transmission and distribution infrastructure that conveys electricity to the customer. In the first quarter of 2021 for instance, despite an available generation capability of 8,145MW, GENCos were only allowed to send less than 4500MW to distribution companies, thus losing an average of 3,659MW daily (Salau, 2022:6).

Also, recent technical audits (NCC Daily Broadcast) confirm that Nigeria has a generation capacity of 13, 00MW with more generation capacity coming up, also a transmission capacity of 6500MW to 7000MW but still is unable to wheel an average of 4500MW on a distribution level voltage. Rejecting the load generated has huge technical and commercial implications for other stakeholders in the electricity sector. Generation companies due to system instability are forced to increase the maintenance of their machines thereby spending far more than expected; this includes frequent overhauls of their machines due to grid instability caused by load rejection, increased fuel or gas use, services of control devices, resultant wear and tear of rotating parts in machines etc.

Integration of the Independent Power Producers and Challenges of Electricity Generation in Nigeria

Independent Power Producers (IPPs) are power plants owned and controlled by individuals and investors who were licenced to produce electricity to ameliorate the challenges of electricity generation in Nigeria.

Requirement for Licencing Independent Power Producers

The Nigeria Electricity Regulatory Commission (NERC) is a body charged with the responsibility of regulating standards of performance for all electricity licensees and monitoring performance to ensure that standards and efficiency are met and maintained. According to the NERC regulations, the following requirements were outlined for potential applicants under the IPP licence:

General Requirements for Power Generation:

(i) Site Map: Showing fuel delivery and storage locations, transmission evacuation site, water pipelines, gaseous, liquid and solid waste disposal areas etc.

(ii) Location Map: Showing Roads, Rail Lines, Transmission Lines, Rivers, Reservoirs, etc.

(iii) A principal single-line diagram of the project site.

(iv) Fuel Sourcing, Transportation and Supply Arrangements.

(v) Water supply and availability analysis for plant and staff use.

(vi) Plant Design. (vii) Power Station Information:

1. Total capacity (MW)
2. Number of Generating Units
3. Size of Generating Units (MW)
4. Expected Annual Generation (MWh)
5. Proposed Running Regime
6. Station Load/Load Factor

(vii) Generator Unit Information

(viii) Engineering, Procurement and Construction (EPC) Contract.

(ix) Report of evacuation studies (For Grid Connection):

1. Load Flow Studies
2. Stability Studies
3. Short Circuit Studies

(x) Environmental Impact Assessment (EIA) and Waste Management Plan.

(xi) Expected date of Commissioning

(xii) Evidence of approval from Transmission Company of Nigeria (TCN) confirming that the proposed connection point can take load which will be fed to it Connection

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Source: Regulation No: NERC-R-0110A

The IPPs provide a platform for private investors to build, own, and operate power plants by generating and selling electricity to the national grid through a bulk buyer.

Table 7: Some existingIndependent Power Producers integrated into the national grid after 2013

Independent Power Producers	Year Built	Installed Capacity	Location
Shell-operated – Afam VI	2009	642MW	Rivers State
Agip operated – Okpai	2005	480MW	Delta State
Ibom Power	2009	190 MW	IkotAbas, Akwa Ibom
NESCO	N/A	30MW	Bukuru, Plateau State
AES Barges	2001	270MW	Niger State
Alaogi Power Station	2012	140 MW	Abia State
Omoku Power Station	2005	150 MW	Rivers State
Azura Power Station	2018	450 MW	Benin City

Source: Compiled by the authors, data generated from https://nerc.gov.ng/index.php/home/nesi/403-generation

Table 7 shows some of the IPPs that were integrated into the national grid following the implementation of power sector reform in 2013. In line with the government's effort to increase domestic and foreign participation in the electric power sector, modalities were laid down to licence individuals and corporate entities who demonstrate the capacity to independently build power-generation plants and transmit them to the national grid.

In 2017, the NERC, after the requisite satisfactory evaluation process, issued a total of fifteen (15) new generation licences and approved the change in shareholding for two (2) existing generation licensees. The new licences include on-grid, off-grid, embedded generation, and Independent Electricity Distribution Networks with a total nameplate capacity of 2,280.80MW. A total of eleven (11) new permits were issued for captive power generation with a total nameplate capacity of 153.10MW (2017).

In 2018, the Commission issued a total of twenty-one (21) new generation licences and approved the renewal and capacity amendment of the generation licences issued to KVK Power PVT Ltd and Geregu Power Plc, respectively. The new licences include on-grid, off-grid, embedded generation, and Independent Electricity Distribution Networks with a total nameplate capacity of 4,519.25MW. Similarly, eleven (11) permits were issued for captive power generation (CPG) with a total nameplate capacity of 449.18MW (NERC, 2018).

In 2020, following the satisfactory evaluation of their applications, the Commission issued the following licenses, permits, and certifications. Five (5) new and three (3) renewed generation licences with capacities of 235MW and 346MW, respectively, were awarded. The new licences include on-grid, off-grid and embedded generation. Two new independent electricity distribution network licences Nine new permits for captive power generation spread across Nigeria with a total capacity of 86.70MW (NERC, 2020).

Complementing the IPPs, the National Integrated Power Projects (NIPPs), which started in 2004, were commissioned as a part of power sector deregulation to attain the goals of continuous electricity supply and reduced gas flaring in the Niger Delta region. The NIPP was initially developed around seven medium-sized gas-fired power plants in gas-producing states, as well as the key transmission infrastructure required to evacuate the additional electricity into the national grid. The Federal Government, therefore, incorporated the Niger Delta Power Holding Company Limited (NDPHC) as a limited liability company to serve as the legal vehicle to hold the NIPP assets using private sector-orientated best business practices. NDPHC is incorporated under the Companies and Allied Matters Act as a private limited liability company fully subscribed to by federal, state, and local governments with a mandate to manage power projects (NERC, 2020).

Table 8: List of Power Plants under the National Integrated Power Project managed by the Niger Delta Power Holding Company (NDPHC)

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Power Plant	State	Installed Capacity	Status
Alaoji	Abia state	1,074MW	Own by the 3tiers of government
Ihovbor	Edo state	451MW	Own by the 3tiers of government
Calabar	Cross River	563MW	Own by the 3tiers of government
Egbema	Imo state	338 MW	Own by the 3tiers of government
Gbarain II	Bayelsa State	225 MW	Own by the 3tiers of government
Geregu II	Kogi State	434 MW	Own by the 3tiers of government
Olorunsogo II	Ogun state	675 MW	Own by the 3tiers of government
Omotosho II	Ondo state	451 MW	Own by the 3tiers of government
Omoku	Rivers state	225MW	Own by the 3tiers of government
Sapele	Delta State	450 MW	Own by the 3tiers of government

Source: Compiled by the authors, data generated from https://nerc.gov.ng/index.php/home/nesi/403-generation

Table 8 shows the NIPP which comprised the ten gas-fired plants mainly located in the oil-producing region of Nigeria. These plants are owned by the 3tiers of government but managed by the Niger Delta Power Holding Company. Aside from this, several IPPs are currently under construction including the 276-MW Siemens station in Afam, Exxon Mobils 388-MW plant in Bonny, ABBs 450-MW plant in Abuja, and Eskoms 388-MW plant in Enugu. Several state governments have also commissioned Oil companies' IPPs to increase generation including Rivers State, which contracted Shell to expand the 700-MW Afam station (NERC, 2020).

Challenges of Electricity Generation in Nigeria

Electricity has been in existence in Nigeria for more than 100 years, yet its availability to Nigerians has remained a great challenge. This is because the industry has been plagued by several challenges. Some of the challenges confronting electricity generation in Nigeria are highlighted below.

Ageing Power Generation Infrastructure

One of the major challenges facing electricity generation in Nigeria is the ageing of electricity generation plants. Before the privatisation of GenCos in 2013, on average, most of the functional thermal power plants in Nigeria were more than 30 years old (*see table 1 of this study*). Specifically, the bulk of Nigeria's electricity infrastructure was commissioned between 1963 and 1990 (that is 52–25 years ago). This makes their repair and maintenance extremely difficult as most of these plants' parts have become obsolete even at the manufacturer's end. Consequently, many of these old power stations continually have low available generating capacities, with plants like Ajaokuta, Afam I-V, and Sapele having average availability factors of 0%, 1.5%, and 9.1% respectively (Okedu, Kenu, Idowu, and Uhunmwangho, 2018).

Insufficient Generation Capacity

As indicated in table 3, the average electricity generation is far below the installed capacity. For example, between 2010 and 2013, the total installed generating capacity was 12,522 MW, but the average operating generation capacity was less than 3, 8479 MW, with more than 9.4% lost in transmission and up to 27.7% rejected at distribution daily (Okedu et al., 2018). This leaves Nigeria with around 2,519MW, on average, as of 2013.

Shortage in Gas Supply

One of the major setbacks to electricity generation in Nigeria is the high irregularity in gas supply to the thermal power stations. This irregularity is a key contributing factor to the generation imbalance mentioned in the preceding paragraph. Reasons for this irregularity ranged from unguaranteed Gas Supply Agreements (GSA) between the thermal stations and the government-owned gas transmission company, the Nigerian Gas Company (NGC), to a lack of gas network infrastructure to adequately transport the gas to the plants. These lapses in the gas supply logistics subsequently result in issues of incessant low gas pressure, gas shortages, and even condensate accumulation in the pipelines. All these issues, acting together, adversely hinder the efficient utilisation of the plants' available capacity, thereby having a dire impact

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

on the nation's generating output (Vincent and Udeorah, 2018).

Gas Pipelines Vandalization

One of the major constraints to effective electricity generation in Nigeria is the unstable and continuous vandalization of gas pipelines that supply the thermal power generating plants with gas. In the Niger-Delta region, where most of the thermal power plants are located, gas pipelines are frequently vandalised by oil thieves (Richard, 2019; Rindap, 2015). As a result, most of Nigeria's gas plants are no longer connected to oil companies but depend on supplies from tankers for their required gas supply. It is worth noting that gas power plants currently account for more than 75% of Nigeria's total installed capacity electricity (Adenikinju, 2018).

Outdated transmission and inefficient distribution infrastructure

Another major constraint to electricity generation in Nigeria is the deplorable state and ineffectiveness of the transmission and distribution networks. In 2010, the 330 kV transmission circuit experienced 748 power outages, while the 132 kV circuit experienced 4101 outages (NERC, 2017). When the ratios of the various kinds of outages experienced on both lines are compared, it is clear that the forced and emergency outages outnumber the scheduled outages on both lines. This was similar to the previous year when 655 outages were reported on the 330kV circuit and 4149 power outages were recorded on the 132kV circuits. This demonstrates that the outages occur on an annual basis, exposing an underlying fault in the transmission network. Further investigation into the causes of partial and total grid failures from 1987 to 2022 revealed that: 78% of the failures experienced during this period were caused by transmission faults, while the remaining 22% of partial grid failures were caused by the rejection in the distribution units (Okedu, et al., 2018).

The implication of transmission failures and collapse is severe damage and destruction of generation plants because when the already transmitted electricity falls back to the generation facilities, it causes a huge spark and destruction in the plant, leading to a decrease in production (Stephen, Ebele, Chukwunonso, and Clement, 2017).

The Impact of the IPPs on Electricity Generation in Nigeria

Like privatisation itself, the integration of independent power producers into the national grid has significantly ameliorated some of the challenges facing electricity generation in Nigeria. First, it could be observed that there was little or no impact from IPPs and NIPPs before 2013 when the first NIPPs were commissioned and IPPs became integrated. As was shown in figures 2, tables 4 and 5, the overall performance of electricity generation and power sent out drastically increased from 2015 following the integration of IPPs power plants into the national grid. Compared to pre-2013, as shown in table 6, there were considerable improvements in the actual electricity generated in Nigeria from 2014 upwards. However, despite the significant increase in the actual power generated, our finding shows that the challenges of gas shortages and gas pipeline vandalism persist. The main cause of gas-constrained energy generation is pipeline destruction by militants in the oil-rich Niger Delta region, where gas flaring occurs due to the federal government's negligence in the region's development.

Facts about Electricity Generation in Nigeria

- Do you know that the generation companies have an available capacity of about 8,100mw?
- Do you know that the transmission system can only transmit (transport) about 5,000mw?
- Do you know that there is a gap of more than 2000MW between generation and transmission infrastructural capability?
- Do you know that the distribution network is only capable of absorbing about 4600 MW?
- Do you know that there is a gap of more than 1,500MW between transmission and distribution infrastructural capability?
- Do you know that there is a gap of nearly 4,000MW between generation and distribution capability?
- Do you know that if all the gas needed were made available, Nigeria will have stranded generation of about 4,000MW?

Conclusion

The need to maintain a cost effective, reliable and stable power supply in Nigeria led the federal government of Nigeria to outline a policy direction towards power sector reform. In 2005, the reform act which provided the

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

legal backing for the transfer of power sector asset to the private sector. In 2010, the roadmap for effective reform and privatisation of the sector was perfected and in 2013, through the implementation of the roadmap, the privatisation was completed. Thus this article argues that Privatization of the Power Generation Companies significantly increased electricity generation in Nigeria within the period under study and that the integration of the independent power plants into the national grid ameliorated some of the challenges confronting electricity generation in Nigeria. These are evident by the increase in installed capacity from 7000MW in 2013 to 13, 014MW in 2021. Also the available electricity generation in Nigeria increased more than 180% 7 years after the privatisation.

In the light of the above findings and evidence as shown in tables and figures the article recommends that: The Transmission Company of Nigeria (TCN), which is 100% owned by the government, should be privatised/liberalised to enable private sector investment and the expansion of transmission infrastructure. This, if implemented, will help in evacuating stranded generated electricity, and add more pool in the national grid. It is equally important, judging by the achievement of the six privatised power plants, that the assets of the ten NIPPs and the newly built ones should be transferred to private ownership through another round of privatisation. Secondly that government should find lasting solution to incessant gas pipeline vandalism which is disrupting gas supply to the thermal power plants, thereby, preventing optimal production to full capacity.

References

A. Atiku, N. Koko (2007): Re-organizing Nigeria's power sector-The challenges before the National Energy council (NEC)' ,

Africa Progress Report, 2015.Power, People, Planet: Seizing Africa's Energy and Climate Opportunities,Geneva: Africa Progress Panel.

Abdul, B. O. (1992). Establishing machinery for effective revenue collection in a commercialised National Electricity Power Authourity (NEPA).NEPA Review.

Adebare, A. (1975). The Reorganization Envisaged in Electricity Supply Industry. In Proceedings of The Energy Policy Conference held on 2nd-4th August, 1975 at Jos, Nigeria.

Adelaja, O. O. (2007). Theoretical and empirical issues in privatisation: A comparative study of the British and Nigerian experience. Journal of Social Science, 14(1), 25–43.

Adenikinju A. (2011) Energy Sector Reform: Prices and Private Sector Response' Centre for Petroleum, Energy Economics and Law; University of Ibadan

Alao, A. A., 2016. Residential and Industrial Electricity Consumption Dynamics and Economic Growth in Nigeria 1980-2012. *International Journal of Economy, Energy and Environment*, pp. 48-56.

Albert, O, Abada, M.I & Adibe, R, (2021), Crony capitalism in Nigeria: the case of patronage funding of the People's Democratic Party and the power sector reform, 1999–2015. Review Of African Political Economy Https://Doi.Org/10.1080/03056244.2021.1958309

Aliyu, I., Sanu, M., Muhammed, A., Abba, Y., (2013).An assessment of the power sector reform in Nigeria.Int. J. Adv. Res. Technol. 2 (2).

ALIYU.I, (2017).an Assessment Of The Power Sector Reform In Nigeria. International Journal of Advancements in Research & Technology, Volume 2, Issue2

Amadi, S., (2018) Successes and Challenges of the Power Sector Reform So Far: Next Step. Keynote Presentation at the Nigeria Bar Association. 2nd Annual Energy and Environmental Law Roundtable Yenagoa, Nigeria.

Aminu.I, and Peterside, Z. B (2014). The Impact of Privatization of Power Sector in Nigeria: A

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Political Economy Approach, Mediterranean Journal of Social Sciences Vol 5 No 26

Awosope, C.O. (2014). Nigeria Electricity Industry: Issues, Challenges and Solutions. Covenant University 38th Public Lecture Series, Vol. 3, No. 2, October. Ota: Covenant University Press.

Bacon, R., McPherson, C., Nadifi, N., & Labella, P. (2019).*Global energy sector reform in developing countries. A Scorecard Report No. 219-99*. Washington D.C.: UNDP/World Bank.

Banwo&Ighodalo, (2019). The Nigerian Power Sector Reforms: Overcoming Post-Privatization Challenges, Lagos: Banwo&Ighodalo.

Banwo&Ighodalo, (2019). The Nigerian Power Sector Reforms: Overcoming Post-Privatization Challenges, Lagos: Banwo&Ighodalo.

Borenstein S. & Bushnell J. (2017).An empirical analysis of the potential for market power in Californian electricity industry.*Journal of Industrial Economics* 47(3): 285-323.

Bye, T. & E. Hope. (2016). Electricity market reform: The Norwegian experience. In T. Sorgard (Ed.), *Competition and welfare: The Norwegian experience*. Norway: Norwegian Competition Authority.

Chernenko, N. (2013). The Russian electricity supply industry: From reform to reform? *Cambridge Working Paper in Economics 1342*.

Clarke, T., &Chisto, P. (1993).The political economy of privatisation. London and New York: Routledge.

D. Walubengo, and A. Onyango, (1992) A Energy Systems in Kenya: Focus on Rural Electrification Kengo: Nairobi,

Daily Independent (2011). All rights reserved. Distributed by AllAfrica Global Media (allAfrica.com)

Dike, C (2016). Electricity crisis: Is Ghana going the way of Nigeria? *BUSINESDAY* 5(213).

Dikki, B., (2017). Update- Privatisation Issues , Abuja: Bureau of Public Enterprises.

Dorman, M. (2014).Reform despite politics? The political economy of power sector reform in Fiji, 1996-2013. *Energy Policy* 67: 703-712.

Emodi, N. V. & Yusuf, S. D., (2020).Improving Electricity Access in Nigeria: Obstacles and the Way Forward. International Journal of Energy Economics and Policy , pp. 335-351.

Emodi, N. V. & Yusuf, S. D., 2015.Improving Electricity Access in Nigeria: Obstacles and the Way Forward.*International Journal of Energy Economics and Policy*, pp. 335-351.

Emodi, N. V. & Yusuf, S. D., 2015.Improving Electricity Access in Nigeria: Obstacles and the Way Forward.*International Journal of Energy Economics and Policy* ,pp. 335-351.

Emodi, N., &Dauda, S. (2015). Improving Electricity Access in Nigeria: Obstacles and the way forward.*International Journal of Energy Economics and Policy*, *5*(1): 335-351.

Energy Access Targets Working Group, 2016. More Than a Lightbulb: Five Recommendations to Make Modern Energy Access Meaningful for People and Prosperity,Washington: Centre for Global Development.

Energy Commission of Nigeria (ECN, 2014). National Energy Masterplan, Draft Revised Edition.http://www.energy.gov.ng/index.php?option=com_docman&task=doc_download&

Enoche, U. P., Egware, H. O., &Eyakanor.(2015). The Nigeria electric power sector (Opportunities and Challenges). Journal of Multidisciplinary Engineering Science and Technology (JMEST), 2(4), 494–502.

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Ezirim, G., Eke, O. and Onuoha, F. (2016). The Political Economy of Nigeria's Power Sector Reforms: Challenges and Prospects, 2005-2015. Mediterranean Journal of Social Sciences, 7(4): 443-453.

Ferguson, R., Wilkinson, W. & Hill, R., 2000.Electricity Use and Economic Development.*Energy Policy*, Volume 28, pp. 923-234.

Francis A. Oluleye& Alex O. Koginam (2019). Nigeria's Energy Sector Privatization: Reforms, Challenges and Prospects. Vol-1, (2) 189-197

G. Mohinder and M.Y. Rao, (2007) "Corruption in the Electricity Sector: A Pervasive Scourge" in J. Edgardo Campos and Sanjay PradhanEds)., The Many Faces of Corruption-Tracking Vulnerabilities at the Sector Level, (The World Bank: Washington, D.C.

G. S. Akpan,(2005) "Host Community Hostility to Mining Projects: A New Generation of Risk" in Bastiba, E.; Walde, T., and Warden-Fernandez, J., (Eds.) International and Comparative Mineral Law and Policy: Trends and Prospects (The Hague: Kluwer Law International, 2005;

Gujral, A. (2013). Electricity distribution- buying a complex asset and transforming it into an efficiently run enterprise in a privatised power sector: The pain and the glory. (online) Retrieved from www.pwc.com/ng

Gusau A.M. and Orah A.M. (2018). Independent Power Plants (IPPs): a Panacea to the Growth and Sustainability of Manufacturing Industries in Nigeria. IOP Conf. Ser.: Mater. Sci. Eng. 377 012169

Hashim, A. (2017). An assessment of electricity sector reforms in Iraq. (Online) Retrieved from www.bayancenter.org/en/wp-content/uploads/2017/09/909865676600pdf

Henrich Boll Stiftung, 2017. Comparison of Costs of Electricity Generation in Nigeria, Abuja: Henrich Boll Stiftung.

Henrich Boll Stiftung, 2017.*Comparison of Costs of Electricity Generation in Nigeria*, Abuja: Henrich Boll Stiftung.

Hobbs, B. (2010). Network model of spatial oligopoly with an application to deregulation in electricity generation.*Operations Research*. 34(3): 395-409.

Hobbs, B.F. & Berry, C.A. (2015). Understanding how market power can arise in network competition: A game theoretic approach. *Utilities Policy* 139-158.

Hunt, S. (2010). *Energy reform and privatisation in Latin America: Distilling the signal from the noise.* Mimeo, Inter-American Development Bank.

Imoke L. (2014). The power sector: The catalyst for economic growth and development. Paper presented by the Hon. Minister for Power and Steel and Chairman of the NEPA Technical Committee at an interactive forum with Mr. President.

Isola, W. A. (2017). Market structure in the generation of the Nigerian restructuring electricity industry.*Journal of Energy and Development* 34(1-2): 209-299.

Iwayemi,Akin. (2008). Investment in electricity generation and transmission in Nigeria: Issues and Options. Being a paper presented in the first quarter of 2008 in a summit organized by the International Association for Energy Economics, Ibadan, Nigeria.

Johnson, O. A. (2019). Epileptic Electric Power Generation and Supply in Nigeria: Causes, Impact and Solution. Journal of Contemporary Research in Social Sciences.*Vol. 1, No. 3, pp. 73-81*

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

Joskow, P.L. (2017). Competitive electricity markets and investment in new generating capacity. In Dieter Helm (Ed.), *The new energy paradigm.* Oxford: Oxford University Press.

Joskow, P.L. (2017). Competitive electricity markets and investment in new generating capacity. In Dieter Helm (Ed.), *The new energy paradigm.* Oxford: Oxford University Press.

Ley, K., Gaines, D. J. &Ghatikar, A., 2015.The Nigerian Energy Sector: An Overview with a Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification,Abuja: Deutsche GesellschaftfürInternationaleZusammenarbeit (GIZ) GmbH.

Littlechild, S.C. (2013). Foreword in Sioshansi, F.P. (Ed.), Evolution of global electricity markets: New paradigm, new challenge, new approaches. Waltham, MA: Academic Press, xxvii-xxx.

Ma, J. (2011). On-grid electricity tariffs in china's development: Reform and prospects. *Energy Policy* 39(5): 2633-2645.

Mentis, D. et al., 2015.A GIS-based approach for electrification planning—A case study on Nigeria.*Energy for Sustainable Development*, pp. 142-150

Morimoto, R. & Hope, C., 2011.The Impact of Electricity Supply on Economic Growth in Sri Lanka.Cambridge: The Judge Institute of Management Studies .

Moyo, B., 2012. Do Power Cuts Affect Productivity, A Case Study of Nigerian Manufacturing Firms.International Business & Economics Research Journal, pp. 1163 - 1174.

Muogbo, U. S. (2013). Impact of privatization on corporate performance: A study of selected industries in Nigeria. International Journal of Humanities and Social Science Invention, 2(7), 81–89.

NBS, 2017.*Nigerian Bulk Electricity Invoices and Payment from GENCOs to DISCOs and Offtakers.*[Online] Available at: http://www.nigerianstat.gov.ng/download/510 [Accessed 01 February 2022].

Nigerian Energy Support Programme. (2015). The Nigerian Energy Sector: An overview with a special emphasis on renewable energy, energy efficiency and rural electrification.

Obadote, D., (2019). Energy Crisis in Nigeria: Technical Issues and Solutions. Abuja, Power Sector Prayer Conference.

Office of Vice President of the FGN, (2015).*Nigeria Power Baseline Report,* Abuja: Power Africa.

Ohimain, E. I., (2015).Diversification of Nigerian Electricity Generation Sources.*Energy Sources, Part B: Economics, Planning, and Policy,* pp. 298-305.

Ohimain, E. I., (2019).Diversification of Nigerian Electricity Generation Sources. Energy Sources, Part B: Economics, Planning, and Policy, pp. 298-305.

Oke, Y (2007) Beyond Power Sector Reforms: The Need for Decentralised Energy Options (DEOPs) for Electricity Governance in Nigeria http://www.unilag.edu.ng/opendocnew.php

Okedu, K. E., Kenu, S., Idowu, K., and Uhunmwangho, R, (2018). Impact of the Independent Power Producers and National Integrated Power Projects on the Deregulation of the Nigerian Electricity Sector. Journal of Sustainable Development in Africa Volume 20, No.1

Olaoye, T. et al., (2016). Energy Crisis in Nigeria: Need for Rewable Energy Mix. *American Journal of Electrical and Electronic Engineering,* 4(1), pp. 1-8.

Omoleke, I. I. (2011). Management of electricity generation and supply in Africa: The Nigerian

Academic Journal of Current Research
Vol.10, No.6; June-2023;
ISSN (2343 – 403X);
p –ISSN 3244 – 5621
Impact factor: 6.37

experience. Journal of Public Administration and Policy Research, 3(10), 266–277.

Omoleke, I. I., &Adesopo, A. A. (2005). Privatisation of Nigerian public enterprises: Its practical challenges as a reformulated policy of the fourth republic. African Journal of Public Administration, (2), 64–80.

Onagoruwa, B., (2018). Nigerian Power Sector Reforms and Privatisation, Abuja: Bureau of Public Enterprises.

Onochie, U.P., Egware, H.O., &Eyakwanor, T.O. (2015). The Nigerian Electric Power Sector: Opportunities and Challenges. *Journal of Multidisciplinary Engineering Science and Technology*, *2*(4).

Oseni, M. O. & Pollitt, M. G., (2019). The Economic Costs of Unsupplied Electricity: Evidence from Backup Generation among African Firms. *Cambridge Working Paper in Economics 1351*.

PWC, (2016).The Challenges with Transforming the Nigerian Power Landscape, Lagos: PWC.

Sambo, A., Garba, B., Zarma, I. H. &Gaji, M., (2017) Electricity Generation and the Present Challenges in the Nigerian Power Sector. Journal of Energy and Power Engineering, pp. 1050- 1059

Sambo, A., Garba, B., Zarma, I. H. &Gaji, M., (2017). Electricity Generation and the Present Challenges in the Nigerian Power Sector. *Journal of Energy and Power Engineering*, pp. 1050-1059.

Sen, A. &Jamash, T. (2012) Diversity in unity: An empirical analysis of electricity Deregulation in India states.*The Energy Journal* 33(1): 83-130.

Ubi. P.S JEffiom. L, Okon.E.O, Oduneka A.E. (2012) An Econometric Analysis of the Determinants of Electricity Supply in Nigeria; International Journal of Business Administration Vol. 3, No. (4)

Urgorji, E. C. (1995). Privatisation/commercialization of stated-owned enterprises in Nigeria.Strategies for improving the performance of the economy. Comparative Political Studies, 24(4), 537–560. doi:10.1177/0010414095027004003

Vincent, E. N. & Yusuf, S. D., 2016.Integrating Renewable Energy and Smart Grid Technology into the Nigerian Electricity Grid System.*Smart Grid and Renewable Energy*, pp. 220-238.

Wakeel, I . (2019). Power Sector Reforms in Nigeria: Challenges and the Way Forward. *Journal of Industrial Economics* 47(3): 285-323.