

## Power sector reform and power value chain in Nigeria: challenges and prospects.

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### ABSTRACT

Power sector reform in Nigeria became necessary as a result of inadequate electricity supply, incessant power outages, low generating plant availability and high technical and non-technical losses that characterized the electricity industry under the National Electric Power Authority (NEPA). This study, therefore, examines the challenges and prospects of power sector reform and power value chain in Nigeria. Data for the study were collected from documentary sources and analyzed using content analysis. It is revealed that power sector still face challenges such as financial constraints, which hinder power generation and distribution, vandalism of electric infrastructures, poor billing method, etc. It is recommended that for the reform to bring positive impact on the economy, the federal government should endeavour to provide employment opportunities to unemployed youths to reduce or eliminate the vandalism of power infrastructures in the county. Furthermore, the government and the stakeholders in the power sector should provide pre-paid meters to power consumers to solve the challenges with the estimated billing method. Most importantly, the consumers of energy should be given basic education to enlighten them on the most efficient use of energy to avoid waste.

Keywords: Power sector, energy consumption, power value chain, energy sources, privatization

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### INTRODUCTION

Energy consumption, all over the world, has continued to be regarded as the propelling force behind economic activities, and, indeed, industrial production [1,2]. The importance of energy as a production input became more prominent following the oil crisis of the 1970s. That period ushered in the use of energy, together with labour and capital, as an important input in production. In Nigeria, energy serves as the pillar of wealth creation and engine of growth for all sectors of the economy [3,4]. For instance, the output of energy sector (electricity, petroleum, etc) helps to consolidate the activities of other sectors of the economy by providing essential services to the production activities in agriculture, manufacturing, mining, commerce and other sectors of the economy [5,6]. Thus, major economic and bio activities like running factories, lightning houses, and streets, provision of potable water, keeping hospitals functioning, etc require adequate supply of energy [7]. As part of energy policy of

the country, the government aims at boosting electricity access from 45 percent to 90 percent by the year 2020. In this regard, the government privatized part of the power sector in 2013 in order to promote efficiency, attract private investment, and increase power generation and distribution in the country [8]. According to Stern and [8], electricity is viewed as the highest quality type of energy, followed by natural gas, oil, coal and wood and bio fuels in descending order of quality. [9], in their study, note that the Nigerian roadmap for the power sector reform which was held in August 2013 reveals that the current energy generation in Nigeria was in the region of 6,000 MW. Out of this figure, 4,730 MW, which represents, 79 percent of the energy produced, is from burning of fossil fuels while 1,270 MW, which represents 21 percent of the energy produced is from hydropower. It is against this background that this study is being carried out in order to analyse the

challenges and prospects of power sector

reform and power value chain in Nigeria.

#### ENERGY SOURCES IN NIGERIA

Energy is generally defined as the ability to work. Energy comes in different forms namely, Heat (Thermal), light (Radiant), Motion (Kinetic), Electrical, Chemical, Nuclear and Gravitational. The major

categories of energy that have been identified are stored (potential) and working (kinetic). The two sources of energy are:

##### Nonrenewable Energy sources

This is an energy source that cannot be replenished. The primary energy sources include, coal, oil, water and gas. Thus, electricity production in Nigeria has varied from gas-fired, oil fired, hydroelectric power stations to coal-fired stations with hydroelectric power systems and gas-fired systems taking precedence [9,10]. Greater percent of the Nigeria Coal product are consumed locally, mainly for railway transportation, electricity production and industrial heating in cement production. Nigeria also has abundant reserves of natural gas. The known reserves of natural gas in the country have been estimated at about  $2.4 \times 10^{12}$  cubic metres, which are expected to last for more than a century as

domestic fuel and major export [11]. Nigeria is an oil producing country and the country's export earnings come from the oil sector. Crude oil and coal are called fossil fuels because they were formed over millions of years by the action of heat from the earth core and pressure from rock and soil on the remains (or fossils) of dead plants and creatures such as microscopic diatoms. In Nigeria, most of the energy consumption comes from nonrenewable sources such as coal, oil and natural gas. It is on ground of this that Nigeria's energy sector is vulnerable to external shocks because of the country's over-dependence on fossil fuel [12].

##### Renewable Energy Sources

This applies to energy sources that can easily be replenished. There are five main renewable energy sources namely, solar energy (From the sun), wind energy, hydropower energy (from flowing water), biomass energy (from plants) and geothermal energy (from heat inside the earth). Nigeria is blessed with solar energy with the average solar radiation of  $3.5 \text{ kWh/M}^2$  a day at coastal latitude and  $7 \text{ kWh/M}^2$  at the far North. The availability of solar radiation makes electricity generation in Nigeria viable [2]. Wind energy, according to International Renewable Energy Agency [7], is one of the fastest - growing renewable energy technology. The agency notes that the world-wide installed wind power capacity, both off-shore and on-shore, has increased in almost 20 years from 7.5GW in 1997 to around 564GW in 2018. Most of the areas and locations that are suitable for the installations of wind power are the remote areas because of their wind characteristics. The third renewable

energy, hydropower plants, use the energy of the dropping water in order to generate electricity. The hydropower plants use dam or river to store water in a reservoir. Then, the water which is released from the reservoir runs through the turbine thereby spinning it, which in turn triggers the generator to produce electricity [4]. Biomass is a renewable energy that is obtained from both plant and animal materials. Biomass fuel is used for cooking, heating, transportation and electricity generation. Most importantly, it helps to curtail the effect of greenhouse gases such as sulphure and carbon dioxide, which causes global warming (Arthouros and rana, 2019). The fifth renewable energy source, geothermal energy, is obtained from the heat of the earth. This renewable energy is used mostly to heat buildings and to generate electricity. Renewable and nonrenewable energy can be used as primary energy such as heat, or to produce secondary energy such as electricity.

## POWER SECTOR REFORM AND ELECTRICITY POLICY PRIORITIES FOR NIGERIA

## Power Sector Reform in Nigeria

Power sector reform in Nigeria became necessary as a result of inadequate electricity supply, incessant power outages, low generating plant availability and high technical and non-technical losses that characterized the nation's electricity industry under the National Electric Power Authority (NEPA). Following these challenges associated with the electricity industry in Nigeria, the Federal Government, in 1983, sponsored two panels of enquiry to fashion out the models for restructuring NEPA into an independent unit towards privatization. During the period 1999 - 2005 that ushered in democratic governance in Nigeria, an Act that established the Power Holding Company of Nigeria (PHCN) was enacted. PHCN was therefore an initial Holding Company (IHC) by the government towards revitalizing the power sector in the country. This was an intended name for privatization which was meant to transfer assets and liabilities of NEPA to PHCN. PHCN was then officially commissioned on the 5<sup>th</sup> of May, 2005 and was mandated to carry out the

## Electricity Policy Priorities for Nigeria

The government privatized part of power sector in 2013 in order to promote efficiency, attract private investment and increase power generation in the country (Akanonu, 2018). These are to be achieved through the following five electricity policy priorities namely, namely,

1. Attract investment in the energy sector. The subsidiary objectives in this regard are to

Conduct power asset inventory and audit to determine priority investment needs across the value chain and funding to replace or repair assets. Resolve long standing government liabilities to the electricity sector and create fiscal rules for future payments to prevent debt buildup. Increase the capital allocation for the Transmission Company of Nigeria (TCN) including an analysis of its budget performance. Consider privatization of TCN

2. Solve barriers in the gas -to- power value chain. This is to be achieved through the following subsiding

business of NEPA. After the official commissioning, PHCN was disaggregated into eighteen (18) independent firms as follows: Six (6) electricity generating companies (GenCos), one (1) electricity transmission company (TransysCo) and eleven (11) distribution companies (DisCos). The generating companies are Egbin Electricity Generating Company (EEGC), and those ones at Sapele, Ugheli, Afam, Shiroro and Kainji. There are also some new independent power producers under the auspices of the Niger Delta Power Holding Company (NDPHC). The 11 distribution companies (DisCos) are the electricity distribution companies of Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port-Harcourt and Yola respectively. In 2010, the federal government rolled out the Road Map for the power sector in Lagos with targeted achievement. Thus, the Nigeria's electricity value chain consists of the Six (6) Electricity Generating Companies (GenCos), One (1) Transmission Company of Nigeria (TransysCo) and Eleven (11) Distribution Companies (DisCos).

objectives Launch a federal coordination mechanism covering gas supplies, generation, transmission and distribution. Enforce existing penalties for payment default along the value chain.

3. Plan for renewable energy integration through the following subsiding objectives

Complete development of the 14 planned solar plants. Invest in new grid infrastructure to facilitate integration of intermittent sources. Integrate mini-grid into DisCo networks to supply power to underserved areas.

4. Update tariff schedule to synchronise the payment expectations in the multi-year tariff order (MYTO) and the financing plans of GenCos, TCN and DisCos.

The subsiding objectives in this respect include: Utilize data analysis to more effectively allocate available power. Invest in new IT system for DisCos to enable revenue Collections, management and transparency. Conduct an in-depth assessment of the power sector value

chain to ensure accurate estimation of cost for electricity delivery and tariff adjustment.

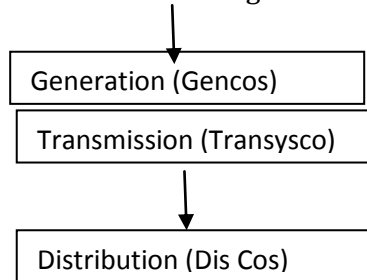
5. Understand demand to guide prioritization. The subsidiary objective to be achieved is to: Study energy demand

to determine the customer profiles, as well as stranded capacity in load rejection to ensure data-driven planning and reduction in technical, commercial and collection losses.

CHALLENGES OF THE NIGERIA'S POWER VALUE CHAIN AND ENERGY PROSPECTS FOR NIGERIA

Challenges of the Nigeria's Power Value Chain

Fig 1. Power value chain in Nigeria.



Generation (GenCos)

The followings are the challenges associated with power generation in Nigeria. Financial constraints. This arises from low cash flow from distribution companies (DisCos). Obsolete generation infrastructure: This adversely affects electricity generation in Nigeria.

Frequent Vandalisation of pipelines and infrastructure by the Nigeria Delta militants. Technical and commercial losses in the transmission of electricity: these adversely affect the generation companies (GenCos)

Transmission (TransysCo)

The followings are the challenges associated with electricity transmission in Nigeria by the TNC. Financial constraints: the federal government budgetary allocation to TNC is inadequate. These is also poor funding of projects and low cash flow from DisCos, for instance, an investigation by [8] reveals that Discos

received only about 39 per cent of its transmission invoice in 2018. Another challenges id transmission infrastructure deficit and poor maintenance of equipment. Grid project design and operation are inefficient and ineffective, these affect electricity transmission in the country.

Distribution (DisCos)

There is also financial constraints which hinder electricity distribution by Discos these constraints arise from Aggregate. Technical's commercials and collection (ATC & C) losses. Inadequate distribution networks and vansalisation of

infrastructures. Insufficient collection and remittance: these challenge arise from poor billing system, meter by-pass, electricity theft and non-payment consumer culture.

Energy prospects for Nigeria

The priorities foe power sector identifies by the federal Government of Nigeria (FGN) are to increase the power generation from the current 3.5MW to 20 GW by 2018 and then extend it to 350 GW by 2043. 10 achieve this alternative sources of renewable energy will be harnessed [8]. In recent years, both the on-grid and off- grid are developing at a fast rate. Hence, a study by [5] reveals that by 2030, about 90 per cent of the population would have access to

electricity in Nigeria. This implies that power sector reform will lead to improves electricity services as it will encourage private sector participation and investment in the electricity industry. In this regard, new power facilities from private sector investment will provide new capital injection in the economy. Furthermore, private sector participation in the electricity industry will create more electricity companies this will invariably create employment opportunities foe a

good number of Nigerian youths that are jobless thereby reducing the crime rate in the country. Before the power sector reform, NEPA was the sole producer and distributor of electricity services in the

country, consequently, power sector reform encourages competition in the electricity industry as a result of private sector.

#### CONCLUSION AND RECOMMENDATIONS

This study examines the challenges and prospects of power sector reform and power value chain in Nigeria power sector reforms in Nigeria became necessary following the challenges faced by the sector such as inadequate electricity supply, incessant power outages, poor billing method and low generating plant availability to mention just a few from the preceding discussions, the reform of the power sector and the power value chain will increase employment opportunities for the unemployed youths in the country. Similarly, private sector participation and investment in the electricity in the industry. This will make electricity accessible to the consumers thereby boosting the economic and social activities in the country. For reform programme to bring positive impact on the economy, the following recommendations are made to prevent frequent vandalism of electricity

infrastructures, the FON should provide employment opportunities to unemployed youths in the country. When the youths are gainfully employed, they will become law-abiding and less restive. The consumers of energy should have access to pre-paid meters. This will solve the problem associated with estimated billing method. The private sector participation in the power sector will go a long way in improving the services in order to encourage customers patronage. Similarly, the consumers of energy must be ready to always pay for the energy consumed given the fact that the utility companies are purely geared towards making profit while rendering the services to the consumers. Most importantly, the consumers of energy should be given basic education to enlighten them on the most efficient used them on the most efficient use of energy to avoid waste.

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