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Review of the Impact of Electricity Supply on Economic Growth: A Nigerian Case Study

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***Abstract**: This work reviews the impact of electricity supply on economic growth. In this background, power supply in Nigeria was studied from 1983 to 2017. Results obtained show that 100% of stake holders and 68% of the general public in Umudike, Abia State, Nigeria agree that power supply in Nigeria has improved in recent times. For every 1% increase in electricity supply, an economy is expected to grow by 3.94%. Inversely, a 1% increase in real gross domestic product leads to a 0.34% increase in electricity supply and consumption. Although, with an improved current generating capacity of 7000 megawatts and distribution capacity of 4600 megawatts, factors such as an increase in load growth, poor maintenance of existing transmission and distribution facilities and lack of adequate physical structure still cause epileptic power situation in most parts of Nigeria. This study recommends that policies aimed at boosting the generating and distribution of electricity supply in Nigeria should be maintained. This in turn would have a positive impact on the economy.*

***Keywords:** Transmission, Electricity, Nigeria, Industry, Economy, Load growth*

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I. INTRODUCTION

Electrical power is an important component for the development of any economy and hence for prosperity. Besides capital and labor, it is regarded as a third important production factor in economic models [3]. More than eight years after the new investors took over the assets of the Power Holding Company of Nigeria (PHCN), most electricity consumers begin to testify that power supply in Nigeria has improved slightly. This is an indication that stable power supply is achievable in Nigeria. In Lagos, customers in some areas under the Ikeja and Eko Electricity Distribution Companies (IKEDC) have testified that supplies to the area have improved since August this year [2]. In Awka, power is stable except for the few minutes that residents experience power outages [2]. This shows that power supply have improved in some areas in Nigeria. Nigeria's electricity supply has shown significant improvements with the current expansion and rehabilitation of the transmissions and distribution systems. Its current generation capacity, however, still continues to hover between 3,000 and 7,000 megawatts [9]. The peak generating capacity was attained in September, 2017 reaching a whooping 7000 megawatts. In order to keep up with the population growth, this generation capacity of 7000 megawatts is plausible.

According to World Bank report [7], in 2015, about 75 million Nigerians lacked access to adequate electricity and Nigeria was ranked highest amongst the countries with electricity access deficit when energy access, efficiency and renewable are on the rise in many developing nations. Much of the electricity distribution network at 2010 -2016 was poorly maintained and the supply in a lot of areas was often described as epileptic in nature, characterized by extreme voltage variations, load discharges, frequent and long outages and reliance by small scale businesses, industries and affluent individuals on off-grid generation [12]. The poor state of power supply in Nigeria was widely viewed as one of the major constraints to the nation's economic growth [10]. While Nigeria has an abundant supply of natural resources, including large reserves of oil and gas, it had one of the lowest net electricity generations [22]. Today however, with funding from World Bank, Japan International Corporation Agency, the African Development Bank, proceeds from the sale of the National Integrated Power Project (NIPP), EXIM China and contractor-financed turnkey projects all making up funding for the power sector reform, this has helped with massive expansion of the electricity distribution networks in Nigeria [18].

Nigeria loses $25 billion (N75 trillion at the current exchange rate of N305 per dollar) yearly due to irregular electricity supply [7]. Besides, accumulated power sector cash deficits from January 2015 to September 2017 amounted to N931 million ($2.9 billion) [12]. This is the total amount underpaid by all the distribution companies (DISCO's). A report from the Manufacturers Association of Nigeria (MAN) in 2016

show that member companies in the past years (2013 – 2015) spent N20.8 billion, monthly on power generation to run production process [9]. The ripple effects of power shortages and constant outages are numerous to the industries. This ranges from cut down in production, job loss to outright closure or relocation to other countries. Companies bear so much loss as outages often occur when goods are in the middle of production. When power is taken unannounced in the process of production, all goods are destroyed. Many MAN members generate power privately and cut of dependence on the national grid [5]. The consequence of incurring high cost of power generation from the industries makes the nations industries less competitive [9]. A 2015 report on the Good Governance Initiative (GGI), say Nigerians spent N3.5 trillion on fuelling there generators annually and N2 trillion spent on running generators by over 17 million small and medium scale enterprises, banks, other corporate entities and traders across the country [7].

It can be inferred that an improved and stable power supply is vital to boost the growth of any economy. Many functions necessary to present day living comes to a halt when the supply of energy stops or fluctuates. The greater the per capital consumption of electric power in a country, the higher the standard of living of its people [21]. The survival of industrial undertakings and our social structures depends primarily upon low cost and uninterrupted power supply. There is therefore need for an improved and regular electric power supply in the country. This work aims to show that an improved power supply Nigeria is a panacea to her industrial/economic development.

II. METHODOLOGY

The method used in this study comprise of a detailed study of existing literature on electric power supply in Nigeria, use of current facts and use of questionnaires.

Electricity supply in Nigeria: Before and after the reforms

Since, 1972 till early part of 2006, Electricity production and supply in Nigeria has been a monopoly of the federal owned Electric utility body known as National Electric Power Authority (NEPA). This utility was charged with the responsibility for the generation, transmission, distribution and sale of electricity to customers and was run as a vertically integrated company as shown in Fig. 2. Lack of adequate funding and managerial strategies resulted in the steady decline in the performance of the utility [1]. The Table 2 showing the generated and the peak demand from 1983 till 2003 illustrates numerically, the poor state of the National Power Supply System. The rapid growth rate, inadequate maintenance of electricity plants, transmission lines and distribution networks made it difficult for the installed capacity to cope with the national load requirements [1].

The electric power reform in Nigeria had so far led to the corporatization and unbundling of the nations' owned Utility, now known as the Power Holding Company of Nigeria (PHCN). The unbundling had led to the establishment of 18 successor companies from NEPA comprising 6 generation companies, one transmission company and 11 distribution companies [6]. The sector has also been deregulated leading to private sector participation in the generation sector and a number of Independent Power Producers (IPPs) are in operation in the country today. Since then, there have been ongoing generation, transmission and distribution rehabilitations and successes have been recorded so far in power generation and transmission levels with current generating capacity reaching 7000 megawatts (see Table 1).

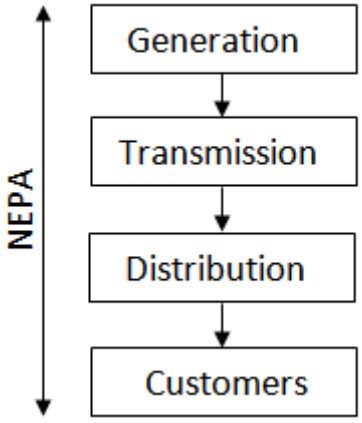

Figure. 1: Power supply model

Table 1: Generated power in Nigeria from 2014 – 2017 [18]

	2014	2015	2016	2017
Jan				2662mw
Feb				
March			3810mw	
April				
May	4044mw			6803mw
June				
July		2800mw		
August				
September			4285.9mw	7000mw
October				
November			3801.19mw	
December				

Figure. 2: Fluctuations in the Nigerian electric generated power [17]

Table 2: Energy demand and generated between 1983 – 2003 [1]

Years	Energy generated (GHW)	Peak max. demand (GHW)
1983	8456	12562
1984	1532	13420
1985	10155	15067
1986	10665	15155
1987	11191	16250
1988	11471	15348
1989	12700	17538
1990	13364	19438
1991	14212	19675
1992	15066	20875
1993	14617	20411
1994	14557	21427
1995	15793	21480
1996	15771	21112
1997	15446	21471
1998	16253	21444
1999	16291	21532
2000	15227	24519
2001	17637	25706
2002	21544	28233
2003	22612	30479

Questions administered to the public and stake holders

165 questionnaires were distributed to the public and stake holders in Umuahia, Abia State, Nigeria. 15 questionnaires were distributed to stake holders and 150 distributed to the public.

Stake holders

1. Opinion of electric power supply before the electricity reforms in Nigeria.

RESPONSE	FREQUENCY
Good	-
Fair	-
Poor	13

87 % say the electricity supply was poor

2. Opinion of power supply after the electricity reforms in Nigeria

RESPONSE	FREQUENCY
Good	15
Fair	-
Poor	-

100 % say electricity supply to most areas improved

Public

1. Opinion of electric power supply before the electricity reforms in Nigeria.

RESPONSE	FREQUENCY
Good	-
Fair	10
Poor	105

91 % say the electricity supply was poor

2. Opinion of power supply after the electricity reforms in Nigeria

RESPONSE	FREQUENCY
Good	87
Fair	41
Poor	-

68 % say electricity supply to most areas improved

Improved Electricity Supply: A Solution to Economic Growth

In this section, the impact of improved electricity supply in some selected developing nations is examined.

a. Sri Lanka

Report in [19] that electricity supply have a significant impact on the change in real GDP in Sri Lanka. An extra economic output of 88000 to 137000 Rupees was predicted for every 1MWh increase in electricity supply.

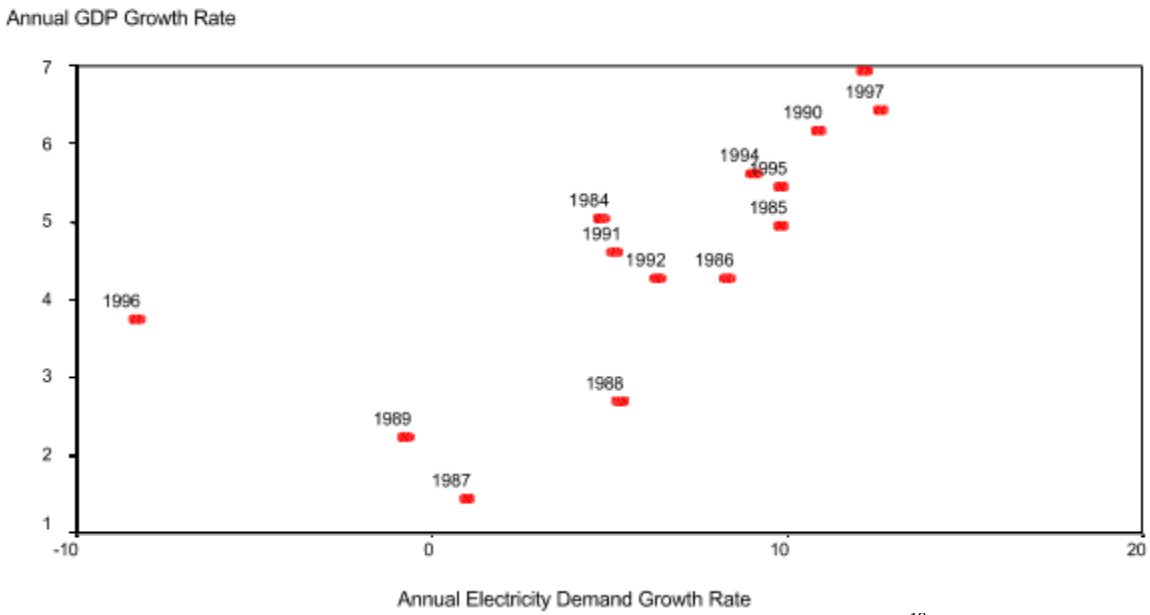

Figure 3: GDP and electricity demand growth rates in Sri Lanka [19]

Fig. 3 shows a strong correlation between average annual growth rates of GDP and electricity demand in Sri Lanka. The correlation was based on the equation.

$\Delta GDP_t = a + \sum_{i=3}^{3} b_i \, \Delta GDP_{t-i} + \sum_{i=0}^{2} c_i \, \Delta ELECT_{t-i} + V_t$ (1)

Where ΔGDP_t is the first differenced real GDP in Sri Lanka at time t.

$\Delta ELECT_{t-i}$ is the first difference of electricity production in Sri Lanka at time $t - i$.

V_t is the error term at time t.

This equation implies that change in real GDP at time t is a function of past changes (with yearly lags up to t-3) in real GDP and of current as well as past changes in electricity (with yearly lags up to t – 2).

Because the energy demand in Sri Lanka is met by hydro power, the serious drought in 1996 meant that Sri Lanka experienced a severe power crisis which adversely affected the economy in 1996 as shown in Fig. 5.

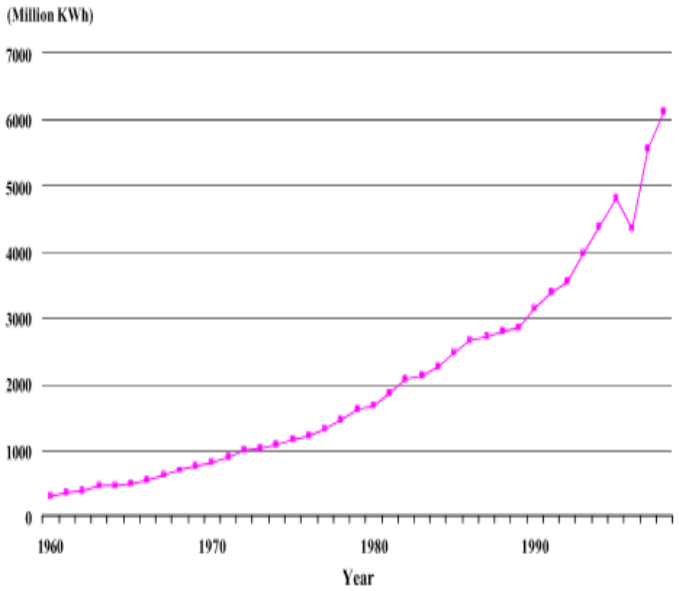

Figure 4: Electricity production in Sri Lanka (kWh) [19]

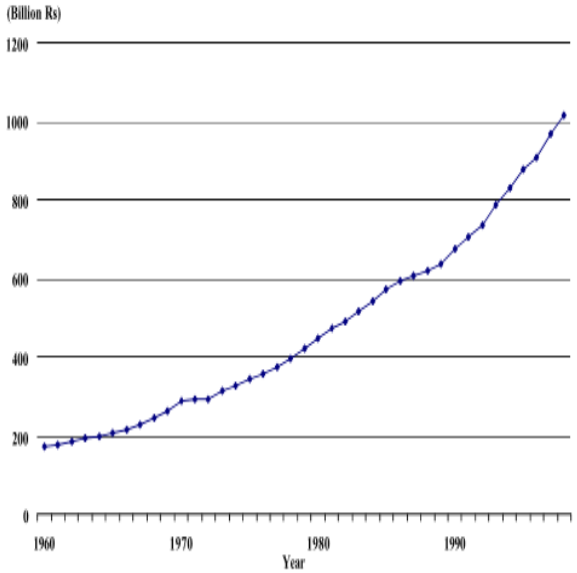

Figure 5: Real GDP in Sri Lanka (Million Rs) [19]

The findings imply that current as well as past changes in electricity supply have a significant impact on a change in real GDP in Sri Lanka

b. Cameroon

[20] examined the effects of electricity consumption on the economic growth in Cameroon from 1980 to 2014. Their results showed that GDP has a positive relationship with electricity generation and consumption. There empirical model made use of the equations:

$$I(ECON) = \beta_o + \beta_1 I(RGDP) + \beta_2 I(EP) + \beta_3 (POP) + \pi \quad (2)$$

$$I(GDP) = \varsigma_0 + \varsigma_1 I(PCON) + \varsigma_2 I(ECON) + \varsigma_3 INF + \varsigma_4 I(GDI) + \varsigma_5 POP + \lambda \quad (3)$$

PCON is the petroleum consumption. EP is the electricity price. ECON is the electricity consumption. RGDP is the real gross domestic product. INF is the inflation rate. GDI is the gross domestic investment. POP is the population growth rate. According to their results, a 1% increase in real GDP will lead to a 0.34% increase in electricity supply and consumption. The statistical test of hypothesis reveals that the result is statistically significant at 1%. This implies that real GDP is a significant determinant of electricity consumption in Cameroun. The authors concluded by recommending that government should give adequate attention and consideration to the power sector in order to enhance economic growth.

c. South Africa

[11] investigated the casual relationship between electricity supply and economic growth in South Africa using data between 1985 and 2014. There results showed that an increased electricity supply stimulated economic growth. There study uses the extended neoclassical production function:

$$GDP = AES^{\alpha_1} K^{\alpha_2} L^{\alpha_3} \varepsilon^{\mu} \quad (4)$$

A is technology. GDP is gross domestic product. ES is electricity supply. K, L and ε denote real capital, labor and error term respectively. α_1, α_2, and α_3 denote output elasticity with respect to electricity supply, capital and labor respectively. Their result was significant at 1% level and showed that with a 1% increase in electricity supply, the economy is expected to grow by 3.94%.

d. Nigeria

Some scholars have argued that power supply is vital for industrial development and is a major challenge confronting the Nigerian economy. For instance, Asubiojo [2] argues that the development of Nigerian economy as an emerging market is technically a function of adequate provision and supply of electricity power. Similarly, [15] argues that poor power generation represents a major setback for Nigeria's industrial development. In the same vein, [16] posits that for three decades (1979 – 2009), inadequate quantity, quality and access to electricity service remain a big challenge to the Nigerian economy and the resolution of the challenge would boost the economy, reduce unemployment and the resultant social vices.

The relationship between electricity supply and industrial/economic growth in Nigeria using data from 1971 to 2009 was studied in [14]. A casual test indicated the absence of a causal link between industrial/economic growth and electricity supply in Nigeria. This implies that electricity supply has not impacted significantly on economic growth in Nigeria owing to the electricity crises that has paralyzed economic activities over the years (1971 – 2009). Ayodele [4] carried out a research on improving and sustaining power (electricity) supply for socio economic development in Nigeria. His results obtained shows that electricity consumption is positively related to economic growth. He concluded that an improved electricity supply and consumption will have a diverse impact in a range of socio economic and industrial activities and also on the living standards of Nigerians.

III. RESULTS AND DISCUSSION

As observed from the returned questionnaires, 87% of stake holders and 91% of the general public in Umudike area of Abia State, Nigeria agree that prior to the power sector reforms in Nigeria, the power supply in Nigeria was epileptic while 100% of stake holders and 68% of the general public say that power supply have improved in recent times. This confirms reports in [2] and [9] that there is an obvious improvement in the electric power supply. The reviews of the impact of electricity supply in some selected developing countries show that an improved power supply is a solution to economic growth. For every 1% increase in electricity supply, an economy is expected to grow by 3.94%. Inversely, a 1% increase in real gross domestic product leads to a 0.34% increase in electricity supply and consumption. [14] has shown that an improved power supply implies lower carbon monoxide (CO2) emissions. This implies that individuals, small, medium and large scale industries would now rely on the grid electricity. This in turn helps boost her industrial/economic growth.

IV. CONCLUSION

In conclusion, with a current generating capacity of 7000 megawatts, there is need for the Federal Government to maintain existing policies in the power sector reforms and take full advantage of the reforms and continue to boost her power generating capacity and distribution nationwide. Lack of access to electricity in some parts of Nigeria will affect development and impinge negatively on the economic growth in those areas

especially the rural areas. While the current expansion and rehabilitation of the transmission and distribution networks is plausible, policies aimed at diversifying the source of electric power in Nigeria should be looked into to avoid reliance on thermal and hydro energy sources. Nigeria is endowed with abundant sources of renewable energy (wind, solar, e.t.c). This can be optimally harnessed to further boost her electric power generation and distribution capacity.

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