An Analysis of the Economic Consequences of Infrastructural Deficit in a Developing Economy: The Case of Electricity Supply in Nigeria

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Abstract: Electricity supply, as a core economic infrastructure in a country, is crucial for promoting economic growth and the well being of the populace. This study examined electricity supply in Nigeria and the consequences of its shortage. This work adopted descriptive analysis approach and gathers data largely from secondary sources. The findings showed that electricity supply in Nigeria had been inefficient, unreliable and grossly inadequate to meet the minimum electricity supply requirement for the Nigerian economy for over three decades. It is characterized by small installed generating capacity, low utilized capacity (less than 50%), low electricity generation from stations and substantial electricity losses. The endemic and perennial electricity supply shortage in the country has resulted in severe economic consequences for households, manufacturing firms and the national economy. There is also environmental implication of poor performance of electric power sector in Nigeria. The widespread use of electric generators for private electricity generation to complement electricity supply from national electricity utility has reduced environmental quality through pollution with its adverse health consequences on the people. Among the recommendations made include adequate and consistent public investment to increase the installed electricity generating capacity of the country to at least 15,000 mw by the year, 2018 and adoption of realistic measures to ensure that installed electricity generation capacity utilization is maintained at a minimum of 70%. There should be substantial upgrading of transmission and distribution facilities in order to minimize electricity losses.

Keywords: Analysis, economic consequences, infrastructural deficit, developing economy.
1. Introduction

Electricity is an economic infrastructure (Todaro, 1980). It is an essential ingredient for economic growth and development of a nation. It plays pivotal role in a national economy by supporting industrial, commercial and agricultural activities. As a critical economic infrastructure, electricity serves dual economic purposes in a country (Ekpo, 2011). First, it is a final good providing service directly to consumers by providing light in homes and offices as well as powering Television Sets, Radio Sets, Air Conditioners, Washing Machines, etc. Second, it is an intermediate good which serves as an essential input in the production process of other sectors of the economy. Electricity is directly and indirectly involved in the production process of nearly all sectors of the economy. It is extensively used as a major source of power in industry, manufacturing and service enterprises like telecommunication, air transportation, electronic banking, entertainment, among others as well as for irrigation and food processing in agricultural industry. The quantity and quality of a country’s electricity supply greatly affects its industrial production, productive capacity, productivity, real GDP growth, aggregate investments and quality of life of the citizens. Hence, efficient and adequate provision and usage of electricity in a country has direct bearing with better economic performance. In line with this, Imran and Philip (1999) described electricity as the pace setter for economic and social advancement in most developing countries as it was once in the Organization for Economic Co-operation and Development (OECD) countries.

In Nigeria, the provision of adequate, regular and uninterrupted electricity is of great importance and had been an integral part of the national policy. In the various National Development Plans as well as the Decree (No. 24 of 29th June, 1972) which established the defunct national utility, National Electric Power Authority (NEPA), government policy objectives on electricity supply had been identified to include developing and maintaining an efficient, coordinated and economical system of electricity supply to all parts of the country, providing adequate, regular, uninterrupted and cheaper electricity supply, and fully exploiting the huge economies of scale in electricity generation, transmission and distribution.

The electric power sector had been regarded as a strategic sector (FGN, 1970) and included among the economic sectors of the Nigerian economy for development purposes (CBN, 1999). For many years, successive Nigerian governments have recognized the critical role of electricity supply in Nigeria’s economic growth and development process and its large capital requirement beyond the capacity of private sector especially at the early stage of Nigeria’s development. The earnest desire to accelerate development in electric power sector resulted in the adoption of public provision, production and pricing of electricity through public enterprise for many years. Consequently, over the years,
successive government in Nigeria had made huge public investment in the development of the sector. For example, in the first, second, third and fourth National Development plans, which covered the periods 1962 – 1968, 1970- 1974/75, 1975-1980 and 1981- 1985, respectively, the planned public investments allocated to electric power sector were N196.3 million, N920.7 million, N927.8 million and N2.46 billion, respectively. The actual public investments allocated in the planned periods were 82%, 104%, 151.8% and 14.9% respectively of the planned public investments (Ekpo, 2011). In addition, between 1973 and 2002, there were various other disbursements made by the Federal Government to the defunct national electricity utility, National Electric Power Authority (NEPA) (Agagu, 2002), in a bid to hasten the development of the electric power sector for effective and efficient performance. The disbursements, which were made in both Naira and Dollars, were N25,350,000.00 and US$15,796,360.92 in 1974. They rose to N540,000,000.00 and US$326,173,621.01 in 1979. However, in 1984, disbursements dropped to N167,571,370.00 and US$128,436,705.76 and were N282,303,446.00 and US$69,142,875.63 in 1987. In the years 2000 and 2001, disbursements by the government were N2,481,000,000.00 and US$26,748,576.32, and N51,045,300.00 and US$446,981,411.21 respectively.

After a long period (29 years) of military rule in Nigeria, civilian administration emerged in 1999. In order to boost electricity supply in the country, power sector reforms were implemented by three successive civilian administrations in Nigeria. The recent in that series of reforms was entitled “The Roadmap for Power Sector Reform” and huge public funds had been expended through the National Integrated Power Project (NIPP). The ultimate goal of the huge public investments in the electric power sector development had been to ensure the provision of adequate, regular and uninterrupted electricity supply at minimal unit cost to all parts of the country in order to enhance better economic performance. According to the National Energy Policy document, “the nation shall make steady and reliable electric power available at all times, at economic rates, for economic, industrial, and social activities of the country” (FGN, 2003). Huge public investment in electric power sector was meant to boost electricity generation, transmission and distribution, thereby ensuring adequate and stable electricity supply in the country in order to raise the real sector productivity and output as well as raise the quality of life of the citizenry.

Despite the enormous public investment and government effort, for about four decades now, it has been observed that the expected adequate, regular and stable electricity supply in Nigeria has remained a mirage. Electricity supply had been grossly inadequate and in a deplorable condition to meet the rapidly growing electricity demand in the country. The demand – supply gap had been so wide; as the generation capacity is estimated to meet
less than 20% of the consumption needs (Akintunde, 2013). First, the installed capacity in Nigeria has been very low compared to that of peer countries. For instance, the installed electricity generating capacity for Nigeria in 2003 was 6,130mw while Netherlands had 21,000 mw, about three times the installed generating capacity of Nigeria. Also, in the year, 2012, the total installed generating capacity in Nigeria was about 4,000 mw with a population of over 160 million whereas South Africa had installed generating capacity of 48,000 mw with a population of about 47 million, about seven times the installed generating capacity of Nigeria. Secondly, the actual electricity generation in Nigeria had been far below the installed generating capacity. In 1970, the installed generating capacity was 804.7 mw whereas only 176.6 mw of electricity was generated, about 21.9 % of the installed generating capacity. The installed generating capacity in 1980 and 1990 were 2,330.5 mw and 4,548.0 mw respectively while electricity generated in those years were 815.1 mw and 1,536.9 mw respectively, about 36.5 % and 33.8 % capacity utilization respectively. The installed generating capacity in 2000 was 5,580.0mw, the amount of electricity generated was 1,738mw, about 31.2% of installed generating capacity while the installed generating capacity in 2010 and 2012 were 8, 820.7mw and 9,937.0mw respectively and the respective electricity generations were 2,981.9mw and 3,268.0 mw. Thirdly, the transmissions and distributions systems had been inefficient as manifested in substantial losses of generated electric energy. About 38 % electricity generated in Nigeria had been lost annually (World Bank, 2002; Eta, 2006).

Consequently, there had been serious electricity supply shortages in Nigeria. Public electricity supply has not been able to keep pace with the level of economic activity, population growth, industrial growth and the rate of urbanization in the country. It has not been able to meet the minimum electricity requirements for domestic, commercial, and industrial purposes. As earlier noted, electricity is critical economic infrastructure in any country. As an engine that drives the real sector of the economy of a nation, it has both forward and backward linkages effects on other sectors of the economy. Hence, electricity supply shortage has great negative multiplier effect on the performance of the economy. It is against this background that this study is set out to examine the socio-economic consequences of the perennial shortage of electricity supply on the performance of the Nigerian economy. Specifically, this study seeks to examine the economic consequences of electricity shortage on individual households, manufacturing industries and national economy. The study is significant in that it provides information to support and direct the efficient allocation of public investment expenditure for rebuilding of this strategic sector of the Nigerian economy. This study shall employ qualitative analysis approach and make use of data largely from secondary sources.
2. Theoretical Discourse and Empirical Evidences

2.1 Theoretical Discourse

Infrastructural facilities are generally “social overhead capital” in the economy which both the ancient and modern economists had recommended as quintessential for better economic performance. Social overhead capital is conceived broadly as all basic inputs into, and requirements for the proper functioning of the economy (Jerome, 1999). Jhingan (2012) described social overhead capital as comprising those basic services without which primary, secondary and tertiary productive activities cannot function. It encapsulates all facilities, physical and otherwise, which help to boost economic and social activities in a nation and which are also necessary for raising the productivity of other factor inputs, and standard of living of the people. It includes facilities for transportation (roads, railways, airports and seaports), electricity supply, water supply and treatment system, postal and telecommunication systems, carnal works for irrigation and drainage, judiciary, health and education.

Traditionally, infrastructure broadly is classified into two categories: namely, social and economic. Social infrastructure consists of health and education facilities and services. Economic infrastructure comprises facilities that provide the society with services necessary to conduct daily life and engage in productive activities (Mody, 1977). By their direct and indirect impacts on the productive processes of the economy, infrastructural facilities enhance economic growth process. Electricity supply is a core economic infrastructure required in a country (Todaro, 1980; Aigbokan, 1999; Ekpo, 2011).

The theoretical framework for analysis of the provision and development of economic and social infrastructure is anchored on the theory of unbalanced growth by Albert O. Hirschman. This theory advocates that since Less Developed countries (LDC) are not sufficiently endowed with resources to invest simultaneously in all sectors of the economy to enable them achieve balanced growth, investment in strategically selected industries or sectors of the economy will lead to new investment opportunities and so pave way to further economic development. Such economy will gradually move from the path of unbalanced growth to that of balanced growth (Jhingan, 2012). Hirschman pointed out that there are convergent and divergent investments; while convergent investments are those projects that appropriate more external economies than they create, divergent investments create more external economies than they appropriate. Jhingan (2012) asserted that development policy should strive at the promotion of divergent series of investments and prevention of convergent series of investments. Hence, for development to take place, a strategy of unbalancing the economy has to be adopted. This is possible by investing either in social overhead capital (SOC) services or in directly productive activities (DPA). Investment in SOC is advocated since it will encourage private
investment later in DPA. Some SOC investment is required as a prerequisite for DPA investment. The growth strategy of massive investment in SOC such as power supply, irrigation, transport, communications, energy, education and health has been pursued in many countries including India, Russia, China, and even Nigeria.

2.2 Empirical Evidence

The relationship between economic infrastructure (with reference to electricity supply) and economic growth is well established in the literature. Familoni (2002) analyzed the role of economic and social infrastructure in economic development and stressed that economic infrastructure play positive and significant role in the growth performance of many countries as it expands the productive capacity of the economy. He maintained that in countries like Korea and Japan where the growth of infrastructure has followed a rational, well coordinated and harmonized path, growth and development has been greatly boosted whereas in most African countries and other less developed countries where growth of infrastructures has not followed a rational and coordinated path, growth and development has been stunted. Familoni (2002) concluded that infrastructure (economic and social) provides the basic foundation on which the super structure of growth and development can be erected. Once the infrastructural foundation of a country is strong, growth and development will be attainable, continuous, stable, quantitative and qualitative.

Assessing the state of infrastructure in Africa and its significance in the development of the African Continent, Oshikoya and Hassain (2002) posited that infrastructural services are central to poverty reduction and the lacks of access to infrastructure by households are real welfare issues, particularly in rural areas where poverty is predominant. The existence of adequate infrastructure such as electricity supply, water supply, transportation is sine qua non for successful rural transformation and agricultural development. The inadequate state or non availability of infrastructure has adverse impact on health, education, living standard of the people and the capacity of local producers to produce as well as their ability to compete in international markets. In the same vein, Jerome (1999) observed a strong relationship between the availability of certain infrastructure such as electricity supply, telecommunications, surfaced roads and safe water and per capita GDP. He maintained that electricity, telecommunication and water are used in the production process of virtually every sector of the economy and, the quality and quantity of these infrastructural facilities are important determinant of private sector productivity and output. In the absence of adequate electricity supply, water supply, transport and communication facilities, for example, production process or location advantages may not be optimized. The provision of adequate electric power enhances the
functioning of manufacturing firms. It also makes possible the use of modern technologies and processes which are crucial for economies of scale and its attendant benefits.

Electricity supply, as a vital economic infrastructure, is crucial in promoting economic growth and social well being of the populace. The World Bank (1994) averred that electricity supply contributes to economic growth by supporting industrial, semi industrial, commercial and agricultural activities. The provision of adequate electricity in a reliable manner promotes the production of goods and services in the economy; as it provides power for manufacturing and services enterprises such as telecommunication, transportation, electronic banking, among others as well as for irrigation and food processing in agricultural industry. It helps to reduce the production and transaction costs of doing business, which in turn affects both public and private sector output. Its shortage can lead to interruption in production, increased costs and can create disincentives to investment.

Weiss (1999) conducted econometric analysis on a sample of 31 developing countries (Latin America and Africa) to examine the impact of infrastructure on economic performance. African countries included in the sample were Algeria, Burundi, Cote’ de vorie, Egypt, Ghana, Kenya, Malawi, Senegal, Tanzania, and Tunisia. To allow for country specific characteristic, a combination of time series and cross sectional data were used. The model adopted was a variant growth accounting approach whereby growth of GDP per capita is explained by combination of state variable that reflect the capital stock of the economy at the beginning of the period of study and control variable that reflect economic policy. The result showed that power capacity per capita and road length per capita (which were proxies for electricity supply and road infrastructure, respectively) are significant with positive sign. This implies that electricity supply is positively associated with economic growth.

Aigbokhan (1999) carried out a study to assess the impact of infrastructure on private investment and economic growth in Nigeria. He adopted an extended Cobb-Douglas production function and regressed output on each of the infrastructure components introducing each of them at a time. The infrastructure components were electricity consumption, electricity generation, transports, communication and health-care. The regression result, using Ordinary Least Square (OLS) method with annual data covering the period (1980 -1997), showed that electricity consumption and electricity generation recorded statistically significant impact on economic growth.

Despite the positive and significant impact of electricity supply on economic performance, there have been serious electric power shortages in many countries such that
electricity supply seriously lagged behind the rate of growth in electricity demand. Imran and Philip (1999) observed that there had been problems in meeting peak demand for electricity in China, India, Pakistan and the Philippines and stressed that non-availability of adequate electricity supply from thermal plants was due to lengthy downtime and that of hydropower plants was due to fluctuating water availability, and these problems often make the actual available electricity far lower than installed capacity particularly at peak times thereby leading to frequent outages and fluctuating voltages. Other factors which militated against adequate electricity supply in those countries identified by Imran and Philip (ibid) include inadequate capital, poor maintenance, electricity losses and theft of power.

In Nigeria, for about four decades now, it has been widely observed that electricity supply had been grossly inadequate to meet the rapidly growing electricity demand in the country (Adenikinju, 2005; Diji, 2005; Ekpo, 2012). As Adenikinju (2005) averred, the shortage of electricity supply in Nigeria corresponds to a condition of suppressed demand. Suppressed demand is of three types: those who are not covered by the public supply (some 60% of the population), those who supplement the public supply with private provision, and those who are covered but prefer to use private power for reasons of quality and security. Inadequate and unstable electricity supply in Nigeria has forced business enterprises, government establishments and even households into generating their own electricity at higher cost.

3. The Performance of Nigeria’s Electric Power Sector

The performance of Nigeria’s electric power sector is analyzed in terms of the installed generating capacity, electricity generation, capacity utilization, electricity supply and electricity losses in transmission and distribution.

3.1. Installed Generating Capacity, Capacity Utilization and Electricity Generation

Figure 1, which is plotted from Appendix 1, shows the installed generating capacity, capacity utilization, electricity generation, electricity supply and electricity losses in Nigeria for selected years, between 1970 and 2012. As shown in the Figure, Nigeria had 804.7 mw electric power installed capacity in 1970. It rose to 2,330.5 mw in 1980 reflecting an average growth rate of 18.96%. By 1985, electric power installed capacity had risen to 3,695.5 mw showing an increase of 58.58% over the installed capacity of 2,330.5 mw in 1980. The installed generating capacity stagnated at about 4,548.0 mw from 1987 to 1998, a period of 11 years. It rose to 5,580.0 mw and 6,180.0 mw in 1999 and 2001, respectively. By the year 2005, the total installed generating capacity declined to 6,130 mw due to poor maintenance of the facilities. However, the installed capacity
increased marginally to 6999.5mw in 2006. This capacity, even if the plants were operating optimally, was too small, compared to installed generating capacity in many other countries of the world as mentioned earlier. For instance, South Africa had installed generating capacity of 31,000 mw in 1996, about five times Nigeria’s installed generating capacity. Also Netherlands had installed generating capacity of 21,000 mw in 2003 (Damme and Zwart, 2003). This was about three times the installed generating capacity of Nigeria in the same year.

In spite of the low installed generating capacity, it is surprising to also observe that the utilized installed generating capacity which reflects the actual electricity generation in Nigeria had been very low. Between 1970 and 2012, a period of 43 years, the utilized capacity had been below 50%. As shown in Figure 1, in 1970 the utilized capacity was only 21.9% and 145.3mw of electricity was generated. The utilized capacity in 1980 and 1990 were 36.5% and 33.8%, respectively and the respective electricity generations were 536.9mw and 898.50mw. In the years, 2000, 2005 and 2006 the utilized capacity was 31.2%, 45.3% and 33.7%, respectively. The electricity generations in those years were 1,017.30mw, 2,779.3mw and 2,638.1mw, respectively. Although, electricity generation has increased in absolute amount, its growth in relation to installed generating capacity in the country has not been impressive.

![Figure 1: Installed Capacity, Capacity Utilization, Electricity Generation, Electricity Supply and Power Losses in Transmission in Nigeria (1970-2012)](image)

Among the factors identified to have hampered adequate electricity generation in Nigeria are deterioration and decay of and inadequate electric power infrastructure. The generation, transmission and distribution capacity had been inadequate due to
obsolescence of equipments, long period of neglect, inadequate maintenance, inadequate investment in the purchase of spare parts and new modern equipments, inadequate operating revenue, equipment vandalization, among others (Ukpong, 1976; Uchendu, 1993; Alanyande and Francis, 2002).

Ilori (2002) linked the problems of inadequate generation of electricity to the fluctuating decline in public investment in the transmission system between 1980 and 2000 and inefficiencies in the monopoly in charge of providing electricity in the country. Diji (2005) also attributed the limited growth in electric power sector to persistent under-funding by successive governments for several years. This limited capital funding has militated against expansion of capacity to keep pace with growth of the population and the level of economic activity. In addition, severe under-funding of the recurrent expenditure required to maintain existing capacity has resulted in the deterioration of power supply across the energy chain thereby making the nation’s electric power infrastructure fragile and unable to sustain the country’s minimum average electricity demand.

3.2 Electricity Supply and Losses in Nigeria: It is not the exact quantity of electricity generated in Nigeria that has been available for use in the country. A good portion of electricity generated is lost in the course of transmission and distribution. As shown in Figure 1, electricity losses had been in the increase since 1975. It increased from 31.3mw/hr in 1970 to 76.6mw/hr in 1975. In 1980 and 1985, 278.5mw/hr and 449.4mw/hr of electricity generated were lost in transmission and distribution; which represented 34.1% and 38.5% loss of electricity generated in the country then. Electricity losses increased to 52.5% in 1999 and reached its climax in 2003, as it rose to 976.1mw/hr, about 75.4% of electricity generated. It, therefore, follows that electricity supply in Nigeria is the total amount of public electricity generated less electricity lost in transmission and distribution. It is the total amount of public electricity which is available for use in the country. A cursory look at Figure 1 reveals that in absolute term, there was an increase in electricity supply in Nigeria between 1970 and 1993. From 1994 to1999, electricity supply in the country took a downward trend. However, it started increasing again from the year 2000. It rose from 1,017.30 mw in 2000 to 2,898.50 mw in 2012.

The World Bank Report (1995) rated Nigeria as the worst performer in the power sector out of 20 developing nations. The rating shows Nigeria as having the highest percentage system losses, lowest generation capacity, lowest collected revenue as well as lowest return on investment. Usifo (2003) identified the problems which militate against efficient electricity production system and adequate supply of electricity in Nigeria to include low power supply from generating stations, vandalization of electricity line conductors and
equipment, damaging of distribution power transformers due to bush burning along distribution lines. Others are transformers, conductor and cable overloading, broken electric poles for carrying conductors, damaged underground cables due to civil works, etc. Similarly, while analyzing the characteristic of the electricity market in Nigeria as well as the cost of power outages to the business sector of the Nigerian economy using both survey technique and the revealed preference approach, Adenikinju (2005) averred that among the factors which affect the quality and quantity of power supply in Nigeria are power generation limitation, declining investment in the power industry, stagnating expansion to meet rising demand for electricity, and over-aged tired hydro and thermal plants requiring rehabilitation. The study also showed that poor state of electricity supply in Nigeria has imposed significant costs on the business sector of the Nigerian economy. The bulk of these costs come in the form of expenses made in the acquisition of electricity generators and stabilizers for private electricity generation to back-up public supply of electricity.

The supply of electricity had been adversely affected by shortage of foreign exchange and unstable foreign exchange rate. Lack of access to adequate foreign exchange hinder the acquisition of essential inputs (like gas and fuel) and equipments and spare parts thereby rendering essential equipments inoperative. Isola (2005) observed that inputs of electricity production are trade-able goods (gas and fuel) which are normally denominated in foreign currency, but the outputs are mostly sold within the country in local currency. Isola (ibid) maintained that the achievement of efficient supply of electricity at affordable tariffs therefore, hinges on stable exchange rate.

The inappropriate electricity pricing policies which prevailed for a long time in Nigeria has also been identified to have contributed to the inadequate capacity expansion, low electricity generation and supply in Nigeria. There had been a problem of establishing optimal prices in order to have a fair return to investment in the electric power sector. The inefficient tariff system makes it difficult to charge appropriate economic tariffs to recover the cost of producing electricity. This reduced revenue for expansion in the electric power sector. According to Chang (1999), the World Bank estimated that electricity rates in developing countries, Nigeria inclusive, were substantially below those needed for recovery of investment and operating costs. The World Bank(1994) posited that electricity rates in developing countries were about one - half the tariff in OECD countries and as a consequence did not encourage the efficient use of electricity. For instance, for developing countries as a whole, World Bank (ibid) estimated annual losses to the industry to be US $170 billion, US $30 billion of which are attributable to system losses with the remainder to under-pricing and poor billing and collection practices.
Technology adopted in electricity generation affects electricity supply. Among the electric power generation technologies are hydro, thermal, nuclear, etc. Thermal electric power production could be through steam turbine (coal fired, gas-fired, fuel-oil-fired, lignite, etc), gas turbine and diesel. Asmah (2008) reported that due to dominance of hydropower in electric power generation in Ghana, power supply is subject to the vagaries of the weather. In Nigeria, Diji (2005) lamented a recent shift to thermal power stations against the more efficient hydro-power plants. Diji (ibid) maintained that electricity generated from the thermal plants suffers series of set-backs because of frequent shut down of thermal plants due to break down of thermal plants, non-supply of gas, vandalization of gas pipe lines, repair work on the pipe line between the plant and the supplier company-The Nigerian Gas Company.

3.3 The Demand for Electricity in Nigeria

Electricity has been found to represent the fastest growing source of energy demanded and the largest single energy market in most developing countries (Imran and Philip, 1997). In a study on energy demand in eight developing countries (Brazil, Pakistan, the Philippines, China, Thailand, etc.), Imran and Philip (ibid) observed that electricity demand grows faster than any other sources of energy for households and services industry in all the countries studied. In Nigeria, there had been rapid growth in energy consumption particularly electricity since 1970 when Nigerian economy experienced oil boom (Ayodele and Ayo, 1987; Iwayemi, 1987; Isola, 2005). Though Table 1 portrays increase in electricity supply in the country over the years, the minimum electricity requirement in the country has not been met. All electricity supplied from national utility has been demanded and in an attempt to complement electricity supply in the country to meet the electricity need of the country, there have been widespread private generation of electricity in the country through the use of imported small generating sets. As shown in Table 1, about 99% of manufactured firms in Nigeria generate electricity in Nigeria. More than 70% of individual households and establishment (private and public) has private generators by which they generate electricity.

Electricity supply in Nigeria had been grossly inadequate to meet the rapidly growing electricity demand in the country for about four decades now. For instance, the estimated national consumption of electricity for 2003 was 4000mw whereas available data shows that only 1519.5mw was available for use in the country. In 2004, only 1,825mw was available for consumption while the estimated national consumption was about 4,000mw. The estimated national demand for electricity for the years, 2005 and 2010 were about 6,000mw and 10,000mw, respectively (Diji, 2005) whereas the available electricity supply in the country was far lower. In effect, there had been a wide gap between the demand for electricity and the supply of electricity in Nigeria. Consequently, there have
been serious electric power shortages in the country. There is no gainsaying that the electricity supply shortages had remained a perennial development problem in the Nigerian Electricity Market (NEM). It has become a recurrent issue in all of the national development and rolling plans, thus far.

4. The Economic Consequences of Electricity Supply Shortages in Nigeria

Inefficient, unreliable and inadequate electricity supply can deter national productivity and manufacturing output as well as erode the welfare of the populace due to many economic costs associated with it. The economic costs include increase in direct cost of production, production interruptions and delays, loss of perishable raw materials and outputs, and damage of sensitive electronic equipments. These costs can lead to underutilization of the existing productive capacity, constrained short-run production efficiency and output growth. Consequently, it may produce ripple effects on other sectors of the economy, create bottle necks and slack capacity utilization. Hence, the endemic and perennial electricity supply shortage in Nigeria for over three decades has resulted in severe economic consequences for households, manufacturing firms and the national economy.

4.1 The National Economy

4.1.1 Economic Losses

Indeed, perennial electricity supply shortage and frequent interruption in Nigeria has caused great economic losses to the national economy. For instance, it is on record that in 1981 alone, because of erratic electricity supply in Nigeria, the actual losses to industry was N0.7 billion while commercial and residential users recorded about N0.5 billion (Mohammed, 1989). Furthermore, as a result of inefficient power supply subsector, in 1982, three of the four blast furnace of the Aladja Steel Plant which had over 20 tonnes of liquefied steel which was to be forged into billets and sold to other steel mills for iron and steel production suddenly ceased operation due to unannounced power supply interruption by NEPA. The molten steel solidified into one huge multi-million naira “useless ball of steel” which could not be removed from the furnace (Mohammed, 1989). In 1990, The World Bank estimated Nigeria’s economic loss at about N1 billion as a result of NEPA’s inefficiency. By 2004, the federal government of Nigeria estimated that the nation was losing $ 800 million annually due to unreliable power supply, while the World Bank and the United Nations Development Programme (UNDP) estimated the losses at about N66 billion per year as a result of absence of constant electricity supply (Adenikinju, 2005).
4.1.2. Large Scale Importation and Uses of Electric Generators for private Electricity Generation

In an attempt to complement public electricity supply, and to alleviate the problem of erratic power supply and reduce damage from power fluctuations, many private firms, government establishments/offices and individual households had been forced to invest in their own electric power supply by installing their individual electric power generating units. Kesside (1993) cited in Weiss (1999) reported that a survey of firms in Nigeria in the late 1980s showed that over 90% of the firms had their own generators which were generally operated at a very high cost. The situation worsened over time as Table 1 below shows that about 97% of firms in Nigeria had private generators in 2002. The recent trend is that there is hardly any serious business firm, public establishment or manufacturing firm without its private electricity generator. Also over 60% of middle-income households have private electricity generators in their residents. Independent power generation through private generators is known to be far less efficient and substantially more expensive in terms of capital as well as operating cost compared to power supply of large utilities. For instance, Hoffler (1999) observed that the average generator installed by small and medium scale enterprises in Uganda cost about $25,000 and needed another $10,000 annually for fuel and maintenance. A survey conducted by Business Concord in Nigeria in 1983 cited in Mohammed (1989) revealed that in 1981 and 1983 about N100.5 million and N134.1 million, respectively were spent on the purchase of portable generators by households and small scale business enterprises. In terms of generators for industrial activity, it was found that manufacturing firms in operation spend about N750 million yearly on the purchase and maintenance of electric generating sets. By 2006, the cost of operating generators by business firms alone in Nigeria was between $150 million and $340 million per year (Eta, 2006). This figure is exclusive of the cost of buying and running electricity generators in residential structures or public establishments. Eta (ibid) further maintained that if the total costs of owning and operating electricity generators in Nigeria were to be estimated, the figure would be astronomical. Business Vanguard publication of March, 2005 cited in Eta (2006) put the loss to economy at a whooping $3 billion per annum. In addition to importation of generating sets, over 30,000 voltage stabilizers are sold every month in Nigeria due to fluctuations in power supply. Thus, the failure of national electricity utility to provide adequate and reliable power supply has made Nigeria net importer of generating sets and voltage stabilizers. This has helped to further drain the scarce foreign exchange of the country.

Table 1: Percentage of Nigerian Firms with Private Generators

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<th>Employment Size</th>
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4.2. Manufacturing Industries

4.2.1. Cost of Production in Manufacturing Industries

Though not highly recognized compared to other traditional inputs of production like capital, labour or raw materials, electricity is a very crucial input of production in all the sectors of the economy. It is perhaps a more vital input in the manufacturing sector where the motor of production is actually powered by high-tension electrical energy. However, the energy cost in the total cost outlay of manufactured firm in less developed countries suppose to account for about 2% or at most 5%. In Nigeria, the case is different in that the erratic power supply for over three decades now has beefed up the energy cost share in the total cost and consequently hiked the total cost of production of manufacturing products. First, the high energy cost share is as a result of the fact that the energy crisis has compelled many firms to spend a good part of their capital on own-generation of energy. Expenses on private power generation account for as much as about 40% of production cost in some enterprises. Weiss (1999) stressed that the total expenditures of manufacturing establishment in Nigeria on all types of infrastructure averaged 90% of variable cost with electric power taking half of this share. Second, most of the firms have more than one standby generating set, using different energy inputs. Third, maintaining the generating sets require employing workers and this adds to the cost per unit of output. It has resulted in high production cost and consequently high unit prices of manufactured products, thereby constraining the competitiveness of manufactured goods from Nigeria in both the local and international markets.

4.2.2. Growth of Manufacturing Industries

Electricity shortages have also infringed seriously on the growth of manufacturing industries as well as other business activities in which electricity is a major input. It has led to production interruption, loss of perishable goods, damage to sensitive equipment and loss of orders. There have been wastages of raw and intermediate materials and even finished perishable goods due to lack of electricity for proper storage and preservation. In effect, it has also contributed to low capacity utilization in industries, closure of many manufacturing industries and relocation of many essential industries from Nigeria to other countries like Ghana, South Africa, among others. It is not surprising that the poor
performance era of electric power sector also coincide with low performance of manufacturing sector of the Nigerian economy.

4.3. Individual Households

4.3.1 Imposition of High Cost of Living on the Populace

The high cost of production in manufacturing firms caused by poor performance of electric power sector in Nigeria is shifted to the consumers of manufactured goods in the form of high prices. The resultant effects are cost-push inflation, high cost of living, low real wage and low standard of living, among others. Available data showed that, for most of the years, inflation rates in Nigeria were not only high but double digits. The inflation rate rose from 12.7% in 1991 to 57.2% in 1993 and to 72.8% in 1995, before moderating at 29.4%, 20.2%, 17.9%, and 8.2% in 1996, 2002, 2005 and 2006 respectively. From 1970 to 2006, except for few years (1982, 1985, 1986, 1990, 1997, 1999, 2000 and 2006), there were double digits inflation in Nigeria (Bassey and Onwioduokit, 2012). High inflation rates, especially two digits inflation rate which held sway in the Nigerian economy for many years, seriously disrupted economic and business relations in the country. It was found to exert a strong negative influence on the cost of living and the living standard of the people.

4.3.2 Unemployment and Poverty Implication

Electricity crisis in Nigeria has eroded the welfare of the populace resulting in a large percentage of the people living below poverty line. Electricity shortages experienced in Nigeria for many years now, to a great extent, has contributed directly and indirectly to unemployment and poverty in the country. First, gainful employment is important for individual to earn income and escape income poverty. Apart from denying hundreds of thousands of manpower employment due to its deterioration and none expansion, by restraining the productive sector of the economy such as manufacturing and processing of agricultural products leading to low productivity, low capacity utilization, crisis in electric power sector to a great extend has contributed to unemployment, underemployment and poverty in the country. The unemployment rate in Nigeria as provided by the National Bureau of Statistics was 11.90% in 2005, 19.7% in 2008, 21.1% in 2010 and 23.95% in 2011. Second, its “brain child”, cost push inflation, has resulted in low real wage, low purchasing power, high cost of living and low standard of living of many people in the country. Consequently, it has subjected many people to poverty. Measuring poverty in terms of any benchmark indicator (domestic or international at $1 a day or $2 a day), Nigeria has the highest concentration of the poor people among the Sub-Saharan African (SSA) countries (Umo, 2012). For example, in 2011, Nigeria had about 70.8% of the people living below $1 a day which, based on United Nations estimated population of 167
million of that year, translated into about 118 million Nigerian living in poverty (Umo, ibid).

4.4 Environmental Impact
There is also environmental implication of poor performance of electric power sector in Nigeria. The widespread use of electric generators to complement the low and unpredictable power supply from the national utility has made electricity generation through fossil fuel generating plant a good part of electricity generation mix in Nigeria. This adversely affects environment and the populace in many ways. First, it reduces environmental quality through pollution. One of the most serious forms of pollution is the contamination of the air by various particles and gasses emitted. These pollutants have deleterious effects on the health of the people particularly in urban centres where the population is large. Another dimension of pollution is noise pollution, which is harmful physical and psychologically. In addition to creating nuisance in the environment, it has health implication. It impaired the hearing of the people. Second, there had been green house gases emission from fossil fuel used resulting in global warming. Iwayemi (1998) had stressed that an increase in the burning of fossil fuels to provide energy has been identified as a major factor in the built-up of green house gasses (GHG) in the atmosphere which are posing a serious threat to the ecological balance through global warming. In addition, the negative environmental impact of electric power sector performance also hampers sustainable development. Third, energy consumed in operating private generating plants to produce own electricity is creating a lot of concern because the world’s supply of fuel and oil is limited and at the present rate usage, it may be depleted.

5. Conclusion and Recommendations
Electricity supply, as a core economic infrastructure in a country, is crucial for promoting economic growth and the wellbeing of the populace. This study examined electricity supply and the consequences of its shortage in Nigeria. The findings showed that electricity supply in Nigeria was characterized by small installed generating capacity, low utilized capacity (less than 50%) low electricity generation from stations and substantial electricity losses. For about four decades now, the endemic and perennial electricity supply shortage in the country has resulted in severe economic consequences for households, manufacturing firms and the national economy. For the national economy, it has caused substantial economic losses as well as drained the scarce foreign exchange in the country due to large scale importation and use of electric generators for private electricity generation. In addition to hiking the cost of production of manufacturing firms, it has caused production interruption, loss of perishable goods (raw materials, intermediate and finished goods), damage of sensitive equipment and loss of orders. Consequently, it has infringed seriously on the growth of manufacturing industries in
Nigeria. For households, electricity shortage has eroded the welfare of the populace greatly, resulting in a large percentage of people living below the poverty line by imposing high cost of living on the people and contributing to unemployment in the country.

There is also environmental implication of poor performance of electric power sector in Nigeria. The widespread use of electric generators for private electricity generation to complement electricity supply from national electricity utility has reduced environmental quality through pollution with its adverse health consequences on the people.

We recommend that adequate and consistent public investment should be made to increase the installed electricity generating capacity of the country to at least 15,000 mw by 2018 and realistic measures should be adopted to ensure that installed electricity generation capacity utilization is maintained at a minimum of 80%. There should be substantial upgrading of transmission and distribution facilities in order to minimize electricity losses. The untapped electric energy sources in the country such as solar energy, coal, etc. should be fully exploited and utilized in order to reduce pressure on the national grid.

6. References


