

Effects of Electricity Generation and Supply on National Growth and Human Health: A Case Study of Nigeria

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Abstract— Electricity is a key factor that greatly contributes to the development of a Nation. The use of electricity and its supply are correlated with national development. This study evaluates the effects of electricity supply on a nation's economy and establishes a relationship between both. A total of 22 articles relating to electricity supply and national growth, and the effects of electricity generation from fossil-fueled engines on health, published during the period from 1985 to 2021 are reviewed. The review is categorized into sections based on the aforementioned categories of articles. The results of this paper have shown that a co-integration relationship exists between electricity supply and national growth. Also, it has shown that the noise level emission and pollutant concentration from fossil fuel generators were greater than the recommended values by the WHO, and the carbon emitted during the combustion of these engines is the leading cause of global air pollution and as well, global warming.

Keywords— Economic Growth, Electricity Supply, Energy, Fossil Fuels, Health, Nigeria, Power.

I. INTRODUCTION

Power generation is an indispensable factor in the development and progress of various sectors of a country's economy [1]. [2] described power supply as a prerequisite to a nation's development that cannot be avoided. This means that for a nation to undergo rapid developmental growth, an adequate power supply must be made available.

In [3], electricity was regarded as the third imperative factor of production in economic models besides

capital and labour. Thus, for production to be at its peak, adequate electricity must be provided.

It is a fact that an increase in the production level of a country results in a corresponding increase in its economic growth. From an observatory point, most equipment required for production is electrically powered and operated. Hence, electricity availability could hinder or enhance production and as a result, inhibit or promote national growth. The world bank enterprise surveys identified electricity supply as the most common constraint on the operation of firms (figure 1).

Electricity can thus be said to affect the output of an enterprise, consequently affecting national growth. This is because the output from enterprises contributes greatly to the economy of a nation.

This paper is divided into three (3) sections. Section 1 introduces the topic. Section 2 establishes the relationship between electricity and national growth using Nigeria as a case study. Section 3 concludes the idea presented in the paper.

II. LITERATURE REVIEW

This section reviews a total of 22 papers published between the years 1985 and 2021. Figure 2 shows the distribution of articles according to their year of publication.

This section is further divided into three sub-sections which review articles relating to electricity supply and national growth, a case study of the relationship between electricity and national growth and the noise level from fossil-fueled engines and its effect on health.

2.1 REVIEW OF RELATIONSHIP BETWEEN ELECTRICITY SUPPLY AND NATIONAL GROWTH

Power generation is a necessary factor in the development and progress of a country's economy, ranging from manufacturing, banking, health care, etc. [1]. In [2], power supply was described as a prerequisite to a nation's development which cannot be avoided. [2] also stated that development is grossly limited in any nation whose power supply is characterized by poor power outages. Thus, an adequate electricity supply enhances national growth and development.

The availability of electricity as a factor for speedy economic growth was evaluated in [4]. A cross-sectional regression approach evaluation. Also, panel data that used a dependent variable representing the average gross domestic product over 10 years was involved in the evaluation. Electricity was

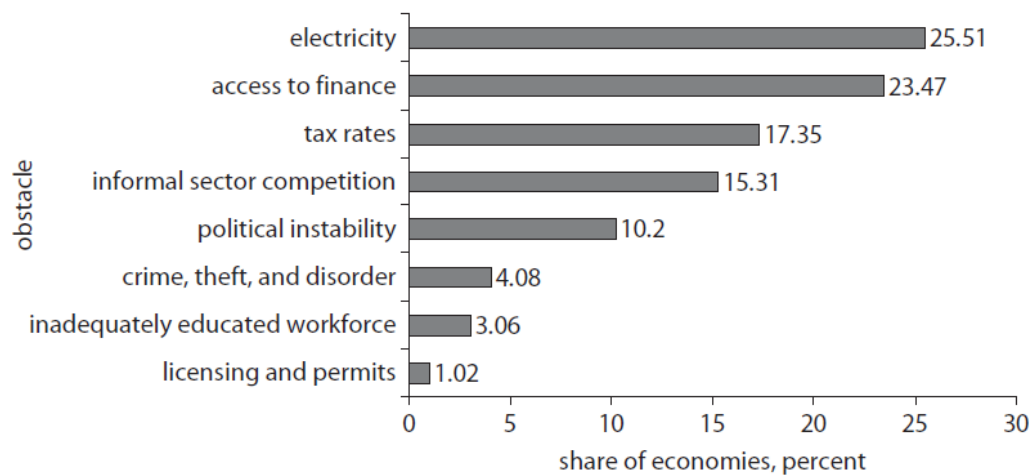


Figure 1: Distribution of major obstacles to enterprise operation

Source: Data of enterprise surveys (2006 – 2010), World Bank, Washington, DC, <http://www.enterprisesurveys.org>

included as an argument in the aggregate production function. Furthermore, quantitative and qualitative measures of electricity were employed including the consumption of electricity by the industrial sector and its generation capacity. The result showed that the availability of electricity had little effect on economic growth and was not a key factor in the fast growth of an economy. Hence, no relationship exists between electricity and economic growth.

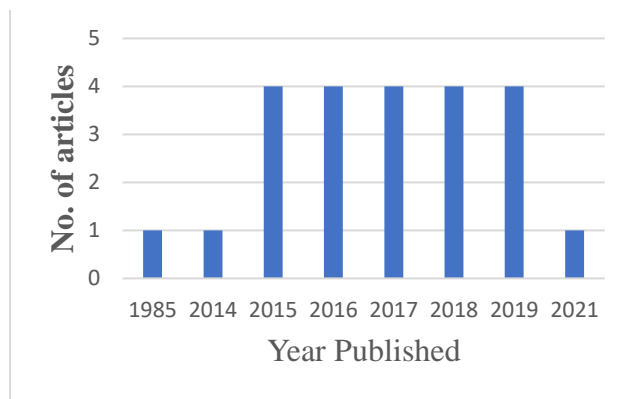


Figure 2. Distribution of articles based on publication year

A microeconomic view of the effect of electricity on economic advancement was presented in [5]. Materials by various researchers were analysed to establish a methodological correlation between the use of electricity and economic development. [5] concluded that works of literature on economic growth and electricity usage were largely available but were mostly inconclusive. Furthermore, the few conclusive materials suggest that electricity availability is not sufficient for economic growth but has the tendency to become very important.

[6] analyzed the effect of energy consumption on economic growth. A total of 29 organizations for economic cooperation and development countries from 1990 to 2013 were studied. The result showed that energy consumption is positively associated with an increase in economic growth rate. Thus, electricity supply has an effect on national growth.

The effect of electricity consumption on economic growth from a global perspective was evaluated in [7]. A panel data of 210 countries over the period of 1960 to 2014 was used in the analysis. A bidirectional relationship was seen to exist between electricity consumption and gross domestic product (GDP). However, for countries using non-renewable sources for electricity generation, a negative relationship was established between electricity consumption and economic growth.

A relationship can be said to exist between electricity supply and national growth because electricity plays an important role in the growth of a nation. The relationship between electricity supply and national growth is established in the next sub-section using Nigeria as a case study.

2.2 A CASE STUDY OF THE RELATIONSHIP BETWEEN ELECTRICITY SUPPLY AND NATIONAL GROWTH

This sub-section analyzes the relationship between electricity supply and national growth in Nigeria. Materials from various authors have been reviewed and a conclusion showing the effect of electricity supply on national growth has been established.

A descriptive analysis approach was used to examine electricity supply in Nigeria and the consequences of its limited availability in [8]. The data used for this analysis was gathered mainly from secondary sources. Despite the use of secondary data, significant results were obtained from the

analysis. The result showed that the electricity supply in Nigeria had been unreliable and inadequate to satisfy the minimum electricity supply requirement for the economy of Nigeria.

Also, the shortage of electricity supply had caused substantial economic losses and had drained foreign exchange due to high importation and use of electric generators for private generation of electricity, causing production interruption and increasing the cost of production, thereby, infringing the growth of manufacturing industries in Nigeria [8]. Hence, the growth of Nigeria has been infringed due to shortage of electricity supply.

[9] also carried out an analysis on the effect of electricity usage on industrial production in Nigeria. An annual time series data gotten from the Central Bank of Nigeria Statistical Bulletin and World Bank's World Development Indicators, over a period of 34 years was used for the analysis. The result of the analysis showed that the consumption of electricity had a negative and statistically insignificant effect on industrial output. This was in contrast to the findings of [8].

The impact of electricity usage on the growth of Nigerian industries was evaluated in [10]. Time series data for 32 years were collected and analysed using co-integration and error correction techniques. The analysis was aimed at estimating the short-run and long-run relationship between the consumption of electricity and industrial growth in Nigeria. The data was obtained from the various publications of the Central Bank of Nigeria and the National Bureau of Statistics. The Romer model was adopted in the research.

The results obtained showed that a co-integration relationship existed between the consumption of electricity and industrial growth in Nigeria. In addition, the study established a positive relationship between industrial growth and electricity generation and consumption in the long run. Hence, in accordance with [8], the findings showed that electricity supply has an effect on national growth.

An exploration into the link between electricity consumption and economic growth in Nigeria from 1971 to 2014 was performed [11]. The cointegration test used for the analysis affirmed the existence of a cointegration relationship between electricity consumption and economic growth. Electricity consumption was said to increase economic growth. Consequently, an adequate electricity supply would cause an increase in national growth.

[12] evaluated the relationship between the consumption of electricity, the output of manufacturing and financial output. Time-series data from 1981 to 2015 was used for the analysis. The result of the analysis indicated the co-movement of the

variable of a long-time horizon. The analysis also showed that variations in industrial output respond more to shock in electricity supply than its shock. Thus, poor electricity supply can be said to impede industrial output and hence, restrict national growth.

Electricity supply can be said to have a cointegration relationship with national growth. That is, there is co-movement between electricity and national growth in the long run. Electricity directly affects production which in turn affects the economy. Hence, the availability of electricity in a nation can determine the level of growth of that nation.

In nations where the supply of electricity is inadequate, alternate means of electricity generation have been adopted. An example is Nigeria where fossil-fueled generators are used as alternatives to the national grid. The next sub-section discusses the effects of the combustion of fossil-fueled engines on the environment and health.

2.3 REVIEW OF NOISE LEVEL FROM FOSSIL-FUELED ENGINES AND ITS EFFECT ON HEALTH

Electricity plays an important role in the development of a nation and hence, its supply should be made adequately available. This sub-section analyzes the effects of generating electricity from fossil-fueled engines on the environment and human health.

[13] made a study on noise description and emission generated by off-grid diesel-powered generators in Nigeria. Diesel-fueled generators installed within 6 months to 14 years with a capacity of 10 to 500kVA were analysed to know their effects on the environment using a pollutant meter, a CO₂ meter and a noise meter. These standard instruments used were placed at 1m from the exhaust pipes of the diesel-powered generators.

In particular, information on the levels of noise and pollutants associated with the operation of diesel-powered generators as well as their effects on public health were provided in [13]. As might be expected, both the average and range of values obtained for the noise and pollutants concentrations were considerably higher than the recommended maximum limits by WHO. Furthermore, the results suggested that the noise and air pollution due to the operation of these generators are hazardous and injurious to the health of the public.

[14] also conducted a study on the level of noise generated by portable electric-power generators of different brands in Nigeria. A CR811C noise meter was used to investigate the noise levels of electric power generators of 50 different models produced by 10 generator brands, used in 7 cities in Nigeria. Twelve successive investigations were carried out to obtain the sound pressure level, perceived noise level and sound power level of each of the 50 electric power generator models

through field measurements and computations within a study duration of 2 years. The noise meter had an accuracy of ± 1 dB.

In accordance with the findings of [13], eighty percent of the values measured as the sound pressure level of electric power generators in the 7 cities exceeded the standard maximum values recommended by the National Institute for Occupational Safety and Health. Thus, constituting a hazardous environment that would affect the health of the residents of those cities if left unmitigated [14].

The dangers associated with fossil fuel generators were assessed in [15] through a complete study of the experience and thoughts of people in south-southern Nigeria. Data used for analysis was primary data gotten from field surveys and investigations as users of fossil-fuelled generators in Port-Harcourt, Uyo and Calabar, with their neighbors. The study area was segmented into 300 clusters and then field surveys and investigations were carried out. Questionnaires were administered to generator users and their neighbours. The findings showed that 80.1% of the 68,400 households surveyed used fossil fuel generators, some of which were fully aware and strongly agreed that the combustion of fossil fuels had harmful effects on the environment and human health.

[16] assessed the noise pollution caused by emission from power generating sets using Nnewi-North as a case study. The noise level data from electricity generators were obtained using a BAFX digital sound level meter during field measurements of environments around the running generators. The readings were taken at noon and night in a day, for three days in a week and over three months. Statistical Package for Social Sciences (SPSS) and One-Sample T-Test and Analysis of Variance (ANOVA) were used to analyse the data obtained.

SPSS was used to determine if a statically significant difference existed between the noise levels measured and the standard set by the National Environmental Standards and Regulatory Agency (NESREA). The findings showed that the values of noise levels at night exceeded the National Environmental Standards and Regulatory Agency (NESREA) standards (i.e. 60dB) [16].

Atmospheric chemistry-general circulation model was used to calculate the effects of air pollution on climate and the health of the public. The results of this model were used to calculate health impact using the Global Burden of Disease methodology and Global Exposure Mortality Model. At the end of the study, the results showed that fossil fuel emission accounted for about 65% of the mortality rate attributable to air pollution. Furthermore, research showed that an excess mortality rate of 2.96 – 4.21 million per year, worldwide, can be avoided by phasing out the use of fossil [17].

[18] evaluated and analysed the environmental noise from power generated from petrol-fuelled portable generators in commercial areas. Different locations at Abeokuta metropolis were chosen for the generator sound level measurement. Measurement of sound intensity was taken at five different distances from the generators using a digital sound level meter. Objective research technique was employed in the data collection and analysis of the noise level was done using a typical noise level scale by Aaberg. The analysis showed that noise from generators used in commercial areas was high, hence, affecting public health and causing environmental pollution. Most of the values obtained for noise levels were higher than the specified limits by the WHO.

[19] investigated the impact of air pollution on climate change and the health of humans using the Niger Delta Region of Nigeria as a case study. Both primary and secondary data were used for investigating the effect of air pollution on climate change and human health of individuals residing in Ogoni land and Government Residential Areas of Uyo metropolis. Primary data were gotten for 70 days using surveys, experimental groups and issuing out questionnaires and interviews. Secondary data were gotten from Central Pollution Control Board (CPCB). The result showed a greater incidence of respiratory diseases and deaths occurred in areas close to factories and refineries (areas where the concentration of air pollution was very high). The study also showed an increase in asthma, pneumonia, bronchitis and other pulmonary infections affecting residents of the area due to the prevalence of the gases in the atmosphere.

A 30-year study was carried out using secondary data collected from the central bank of Nigeria, carbon information analysis annual publication and international energy agency to determine the impact of the emission of carbon on Nigeria's economy. The variables used for the study which were the gross domestic product, emissions from fossil fuels, gas fuels, liquid fuels and solid fuels were subjected to ordinary least square method of analysis. The result showed that the emission of carbon had negative effects on the economy of Nigeria and had adverse effects on the level of gross domestic product by reducing the aggregate productivity and output in the economy of Nigeria [20].

A summary of vast scientific evidence regarding the numerous present and future health impacts of the combustion of fossil fuels on the health of the young was done in [21]. Various materials by different researchers were combined and used as proof to show the adverse effects of the use of fossil fuels on children. In addition, child-centred energy and climate policy to address the effects associated with pollution by fossil fuels were suggested. The summarized data showed that high

significant and economic benefits would be achieved for the children by reducing the dependence on fossil fuels.

In [22], the by-product of the burning of fossil fuels was discussed as the most significant environmental threat to the health of children in the world. The impacts of those emissions were explained and various efforts and policies put in place to curb those effects were documented. [22] stated that the burning of fossil fuels is the major source of global air pollution and contributes greatly to the mortality rate of children.

This sub-section has analyzed the effects of power generation from fossil-fueled engines on human health. It has shown that the combustion of fossil-fueled engines is the leading cause of global air pollution, which could lead to various health issues. Also, global warming has been identified as another effect of the combustion of fossil fuels.

III. CONCLUSION

This paper has shown that electricity is a crucial requirement a nation cannot do without. It has established that a co-integration relationship exists between electricity supply and national growth. Thus, an increase in electricity supply in a nation would cause a resulting increase in the economy and growth of that nation.

Also, the harmful effects of electricity generation from fossil-fueled sources have been analyzed. The combustion of these fuels releases carbon into the environment which is the leading cause of pollution and could result in death. Furthermore, the issue of global warming arises as a result of these combustions. Finally, the noise from these generators is above the set standards for noise levels.

In light of the harmful effects of power generation from fossil-fueled engines, a transition to clean energy, using renewable resources for power generation should therefore be adopted.

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