**ELECTRICITY CONSUMPTION AND ECONOMIC GROWTH: EVIDENCE FROM NIGERIA**

***Abstract***

*As one of the major components of energy consumption, the importance of electricity to economic growth have been recognized not only by economists, but also by businessmen, engineering and government agencies. This paper seeks to investigate the impact of electricity consumption on economic growth in Nigeria for the period of 1986-2021 by using Autoregressive Distributed Lag (ARDL) model. The properties of the series were first check using Augmented Dickey fuller (ADF) and Phillip Peron (PP) unit root tests and the result found a mixture of order of integration which paved the use ARDL model. The findings of ARDL bond test indicate the present cointegration. Evidence from the short run reveals that the speed of adjustment is negative and statically significant, confirming the expected equilibrium process in the short run dynamics among the variables under study. The results also show that, energy consumption, inflation and industrial product are statistically significant and have positive effect on economic growth both in the short run and long run in Nigeria, while unemployment is negative and statistically significant both in the short run and long run. Based on the findings the paper recommends that, government should undertake serious measures to curtail the shortage of electricity consumption in the country in order to promote economic growth in general. More so, the government should adopt appropriate policy that will reduce the level of unemployment which has adverse effect on economic growth.*

***Keywords:*** *Electricity Consumption, Economic Growth, Unemployment, Inflation.*

*JEL: Q43, C32.*

1. **Introduction**

The nexus between electricity consumption and economic growth is widely debatable among researchers for over three decade. One of the most examined issues in growth literature, recently, is the causal linkage between electricity consumption and economic growth. The modern-day climate change, energy crises, rising prices of crude oil, and the ever-growing emission of carbon into the atmosphere have added momentum to the debate. The ability to establish the exact causal pattern between electricity consumption and economic growth is of immense relevance for policy formulation, especially for countries such as Nigeria which rely heavily on electricity as their sole source of energy. Empirical support for electricity-led growth would imply that conservation policies could be disastrous for economic growth, which inherently enhances poverty, and reduces both job creation and societal welfare (see Ghosh, 2002). Further, if economic growth Granger-causes electricity consumption, then there might be little to worry about when implementing. Electricity-related conservation policies (Asafu-Adjaye, 2000, Narayan and Smyth, 2007).

As one of the major components of energy consumption, the importance of electricity to economic growth havebeen recognized not only byeconomists, but also by businessmen, engineering, energy and government agencies. As stated by the US Energy In- formation Administration (EIA): “a country’s economy and its energy use, particularly electricity use, are linked. Short term changes in electricity use are often positively correlated with changes in economic output” (EIA,2013).

Electricity is a factor of production and a driver of capital formation it has the capacity to mitigate air population emerging from the household and increase labor hour (Salmon & Tanguy, 2016). Nigeria is one of the countries that has found extremely difficult to provide adequate electricity for its timing population. Since independent in 1960, the sector has performed below par as about 80 million Nigerians do not have access to any form of electricity in their homes, despite the various reforms in the sector (Okafor, 2018). In 2009, only about 47% of Nigerians had access to electricity (UNDP et al., 2009). Nigeria started generating its electricity in 1896, and the Nigerian Electricity Supply Company (NESCO), introduced in 1929, was the pioneer utility company.

After 22 years of operation, the Electric Corporation of Nigeria (ECN) succeeded NESCO in 1951. ECN acquired both the assets and functions of NESCO. In 1962, the Nigeria Dams Authority (NDA) became a partner to the ECN to assist in the development of hydropower. ECN and NDA later formed a merger in 1972 which led to the emergence of the National Electric Power Authority (NEPA). Probably due to inefficiency and little or no funding, NEPA was later privatized and subsequently called the Power Holding Company of Nigeria (PHCN). With the reform in the sector in 2005, the Nigerian Electricity Regulatory Commission (NERC) became the chief regulator of the sector with 11 distribution companies and 60% of the company's shares were now owned by private investors. The sector was further reformed in 2013 but little or no progress was achieved in terms of electricity generation and distribution as the country could only generate about 3,500 MW which is a far cry from what is expected to meet the demand of about 180 million Nigerians.

On December 18, 2017, the sector achieved a peak power generation of 5,222 MW which was an all-time national high. The main objectives of the paper are to investigate the causal relationship between electricity consumption and economic growth in Nigeria for the period of 20 to 2021.

**2. LITERATURE REVIEW**

**2.1 Conceptual Literature**

**2.1.1Concept of Economic Growth**

**2.1.1 Concept of Economic growth**

Gross Domestic product (GDP) is a measure of the economic activity of a country or region. It is the total value of all goods and services produced in a given period of time, typically a year. Real GDP is a measure of GDP that has been adjusted for inflation, so it represents the value of all goods and services produced in a given period of time in constant prices. This means that the effect of inflation on the value of GDP is removed, making it a more accurate measure of economic growth or contraction. Real GDP is often used as an indicator of a country’s standard of living and economic performance. In other word Real gross domestic product, or real GDP, is a measure of the economic output of a nation, adjusted for changes in the price of [goods](https://learn.financestrategists.com/finance-terms/goods-or-merchandise/). Nominal GDP, often just called “[GDP](https://learn.financestrategists.com/finance-terms/gdp/)“, measures the economic output of a nation using only current prices. (Finance Strategies, 2023)

**2.1.2 Concept of Energy Consumption**

Energy Consumption refers to the amount of energy used by a device, system, or entire economy. It can be measured in a variety of units, such as joules, watt-hours, or British thermal units (BTUs). Energy consumption can be associated with the operation with of appliance and equipment, transportation, industrial processes, and the generation of electricity. It is often used as a way to gauge the environmental impact of human activities, as well as to identify opportunities for energy efficiency and conservation. In other word Energy consumption is the amount of energy used by a person, organization, or machine over a period of time.

**2.2. Theoretical Framework**

The theoretical framework of this study is based on liberalized electricity market theory. According to Osobase and Bakare (2014), the liberalized electricity market theory explains the right of firms to choose to invest in different types of power plants which allow production of electricity at different levels of marginal cost. The theory contends that, since electricity is not storable at reasonable cost, it is optimal for firms to invest in a differentiated portfolio of technologies in order to serve strongly fluctuating demand.

**2.3 Empirical Literature**

So many expert agree that a sources are become the main stream of a nation economy prospect by having so many research elaborate on that for instance Imam et al (2019) investigates Sector reforms and institutional corruption; Evidence from electricity industry in Sub-Saharan Africa, the study adopt a dynamic panel estimator with a novel panel data of 47 Sub-Saharan African countries from 2002 to 2013. We find that corruption can significantly reduce technical efficiency of the sector and constrain the efforts to increase access to electricity and national income. The adverse effects are reduced where independent regulatory agencies are established and privatization is implemented. These findings suggest that well-designed reforms not only boost the performance of the sector directly, but also indirectly reduce the negative effects of macro level institutional deficiencies such as corruption on micro and macro performance indicators. Nkalo and Agwu (2019) 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. Nathaniel and Bekun (2019) explores on the link between electricity consumption, urbanization, and economic growth in Nigeria from 1971 to 2014.the study employ the bounds test and the Bayer and Hanck co-integration tests affirm co-integrating relationship. Electricity consumption increases economic growth in both time periods, while the impact of urbanization appears to inhibit growth. the findings. Therefore, the study recommend that the policies is to ensure efficient electricity supply, curb rapid urbanization, and promote sustainable economic growth were suggested. Yu et al (2019) evaluates the effect of electricity production on industrial development and sustainable economic growth. annual data were employed in the period of 1991–2018 are used and three different models are created by using Vector Auto Regression (VAR) methodology. The findings state that electricity production in BRICS countries has a positive effect on both industrial production and sustainable economic growth. Hence, electricity production needs to be increased for them. Sankaran et al (2019) investigates the effects of electricity consumption, using yearly time series data for the period of 1980–2016 with regard to 10 late industrialized nations. The ARDL bound testing approach, the way to deal with co-integration is applied to estimate the long-run connection between the variables. While, error correction method (ECM) is used to find the short-run dynamics. To test the causality among the variables, Toda-Yamamoto test is performed. The results demonstrate the existence of short-run and long-run relationship among the variables and Toda-Yamamoto causality results support the existence of growth, conservation, feedback and neutrality hypotheses for different nations. The difference in the results can be attributed to structural and macroeconomic parameters. In general, this research brings out a fresh lead of knowledge for late industrialized nations to strengthen their economic development through proficient utilization of energy consumption. Oyeyemi (2018) investigates disaggregate energy supply and industrial output growth in Nigeria using time series data from 1981-2014. The study employed Ordinary Least Square method, Granger Causality and Johansen Co-integration test to carry out the empirical analysis. In view of the findings, it has been observed that, irregular electricity supply has been a major bane to output growth in the manufacturing sector; therefore, it is recommended that the power sector by means of guided private sector initiative should be given more attention for the growth of the nation’s economy.

**3 Methodology**

**3.1 Source of Data**

The study utilizes secondary data for the period of 1990-2021 and also the data were sourced from World Development Indicator (WDI), 2021

**3.1 Model Specification**

The theoretical literature has shown that economic growth is related to electricity consumption and Industrial Production. Therefore, theoretical economic growth function can be presented as follows:

Where: *GDP* represent real gross domestic product, *ELC* represent electricity consumption and *INP* represent Industrial Production. In line with the objectives of this study, Inflation Rate and employment are included in the economic growth function as intermittent variables. Therefore, the new economic growth model is written as follows:

.

Testing for stationarity of the series has become one of the popular tests. This is on account that undertaking unit root test to determine stationarity of variables helps prevent spurious results. The augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests will be employed to test for stationary.

If the results from ADF and PP unit root test indicate that the variables are integrated of the same order, then co-integration test can be conducted. Co-integration means that one or more linear combinations of time series variables are stationary even though if they are non-stationary when they are not combined (Ziramba, 2008). The study applied ARDL bounds test.

The application of ARDL bound test in investigating the long run relationship between the variables involves estimating an unrestricted error correction model (UECM) in first difference form (Madhavan et al*.* 2010). The research applies the following UECMs:

The steps that will be used in the analysis of data are pre-estimation test and estimation test. The Augmented Dickey-Fuller (ADF) unit root tests have been carried out. The tests are based on the equations below:

 \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (4)

 \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (5)

\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (6)

The unit root presence is in each case tested based on the null hypothesis of a unit root, i.e. whether the parameter = 0 or otherwise in the three equations above. If *ρ* equals zero, the series contains a unit root and if it is not, the series is referred to as stationary. In equation (4) the ADF-test with both a constant and time trend is specified. Equation (5) specifies the ADF-test with a constant only and no time trend, and equation (6) specifies the ADF-test with no constant and no time trend respectively. Hence, the set of hypotheses corresponding to equations (4) to (6) to be tested are:

 (The series has a unit root with no time trend.)

;  (The series is stationary with a deterministic trend.)

 (The series has a unit root with no constant and no time trend.)

,  (The series is stationary with a non-zero mean.)

 (The series has a unit root.)

 (The series is stationary with a zero mean and no time trend).

The test regression for the Phillips and Perron Unit Root Test PP tests is:

\_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ \_ (7)

Where is I (0) and may be heteroskedastic. The PP tests correct for any serial correlation and heteroskedasticity in the errors of the test regression by directly modifying the test statistics tπ=0 and Tπˆ.

Furthermore, to capture the relationship between electricity consumption and economic growth in Nigeria, the study employed ARDL model otherwise known as Bound test to investigate the impact of electricity consumption on economic growth in Nigeria. The a-priori expectations for the variables under study are:

are positive (>0) while<0)

The ARDL regression analysis model employed in the study can be expressed as follows:

where α is the intercept, RGDP, ELC, INP, INF and UNPL respectively, are the variables used in the model, εt is the white noise and Δ is the first difference operator. In order to test the long-run equilibrium relationship among the variables the study employs the “F-test” in the ARDL Bounds test based on the null hypothesis of no co-integration [i.e. H0 : δ1 = δ2= δ3 = δ4 = 0], contrary to the alternative hypothesis of co-integration [i.e. H1 : δ1 ≠ δ2 ≠ δ3 ≠ δ4 ≠ 0]. Accordingly, the computed “F-statistic” is compared to both the upper and lower bounds critical value to either reject or accept the null hypothesis (Pesaran et al., 2001).

**4. Results and Discussion**

**4.1 Unit Root Test**

Before conducting cointegration analysis, the time series properties of the series were checked first. Various methods can be used to examine the stationarity or otherwise of the series. In this study, three different unit root tests were employed in order to have the robust results. These are Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests. The tests are conducted at level and first difference with trend and intercept. The Augmented Dickey Fuller (ADF) and Phillips-Perron (PP) unit root tests have a null hypothesis stating that, the series in question has a unit root against the alternative that the variable does not has a unit root. Table 1 presents the results of various unit root tests with trend and intercept as:

**Tables 1 Unit Root Tests.**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **ADF Unit Root Test at Level** | | **ADF Unit Root Test at First Difference** | |
| **Variables** | **T statistic** | **Probability** | **T statistic** | **Probability** |
| **RGDP** | -3.673114 | 0.0396\*\* | -4.268429 | 0.0007\* |
| **ELC** | -1.848453 | 0.6593 | -5.609416 | 0.0003\* |
| **INF** | -3.794239 | 0.0043\* | -4.013057 | 0.0001\* |
| **INP** | -1.722727 | 0.7190 | -4.417359 | 0.0067\* |
| **ENPL** | -0.059983 | 0.9932 | -5.349621 | 0.0006\* |
|  |  |  |  |  |
|  | **PP Unit Root Test at Level** | | **PP Unit Root at First Difference)** | |
|  | **T statistic** | **Probability** | **T statistic** | **Probability** |
| **RGDP** | -1.772061 | 0.6966 | -3.212277 | 0.0190\*\* |
| **ELC** | -1.838945 | 0.6641 | -5.609416 | 0.0003\* |
| **INF** | -3.376883 | 0.0710 | -6.574037 | 0.0000\* |
| **INP** | -1.122290 | 0.9106 | -4.297919 | 0.0090\* |
| **ENPL** | 0.051360 | 0.9954 | -5.348255 | 0.0006\* |

**Source:** Author’s Computation, 2023

**Note: \* & \*\*** indicate Stationary at 1% and 5% level of significant respectively.

Table 1 presents the unit root tests using ADF and PP tests with trend and intercept. The results of ADF unit root tests indicate that, RGDP and INF were stationary at level at 1% and 5% level of significance, while ELC, INP and EMP were stationary at first difference at 1% level of significance and 5% level of significance at first difference. The results of PP unit root tests show that, all the series under study except RGDP were stationary at first difference at 1% level of significance while RGDP was stationary at first difference at 5% level of significance. Therefore, an examination of table 2 reveals that, the series are mixture of order of integration as some variables were stationary at first difference and are thus characterized as *I (1)* processes, while others were stationary at level and are thus characterized as *I (0)* process. This mixture of *I (1)* and *I (0)* processes justified the used of ARDL model in this research to check the cointegration due to its advantage over other estimators. As one of the requirement for using ARDL model is that, some variables should be *I(0*) while other variables should be *I(1)*and none of the variable should be *I(2)*. Since the variables found to have characteristic of both I(0) and I(1), the next step of the study estimates the short-run and long-run elasticity based on the optimal lag model ARDL (2,2,1,1,1) selected using the Akaike information criterion shown in figure 1.

**Figure 1: Model selection using Akaike Information Criterion**



**Source:** Author’s Computation, 2023.

**4.2. ARDL Co-integration Analysis**

After selecting the optimal lag model to be used in the ARDL regression analysis, this research examines the co-integration among the variables using the ARDL bounds test based on the null hypothesis of no long-run relationship. Evidence from Table 2 shows that the F-statistic value (  11.33> I1 Bound) lies above the upper bound critical values at 10%, 5%, 2.5%, and 1%, rejecting the null hypothesis of no long run relationship exist at 1% level of significance and concluded that, the variables under study are co integration in the long run.

**Table 2 ARDL Bounds Test**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **F-statistic** | **Significance** | **I0 Bound** | **I1 Bound** | **Null Hypotheses** |
| 11.32924 | 10% | 2.2 | 3.09 | No long - run relationship |
| K=4 | 5% | 2.56 | 3.49 |  |
|  | 2.5% | 2.88 | 3.87 |  |
|  | 1%\* | 3.29 | 4.37 |  |

Note: \**Denotes rejection of the null hypothesis at 1% significance level*

**Source:** Author’s Computation, 2023.

Since the variables are cointegrated, the study estimated the short run and long run elasticity, which is shown in table 3. The result indicates that the speed of adjustment [ECT (-1) = -0.01 with P- Value =0.0000] is negative and statically significant at 1%, confirming the expected equilibrium process in the short run dynamics among the variables under study.

Table 3 presents both the short run and long run dynamic of the ARDL model. The result reveals that in the short run Electricity Consumption (ELC), Inflation (INF) and Industrial Product (INP) are statistically significance at 1% level and have a positive impact on Economic Growth (RGDP) in Nigeria, while Unemployment (UNPL) is statistically significance at 1% level and have negative impact on Economic growth in Nigeria respectively. In the long run also the results reveal Electricity Consumption (ELC), Inflation (INF) and Industrial Product (INP) are statistically significance at 1% and 5% level of significance and have a positive impact on Economic Growth (RGDP) in Nigeria, while Unemployment (UNPL) is statistically significance at 5% level and have negative impact on Economic growth in Nigeria respectively.

**Table 3 ARDL Cointegration Result**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cointegrating Form | | | | |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
| D(RGDP(-1)) | -0.3015460 | 0.102427 | 2.944020 | 0.0075\* |
| D(ELC) | 27.990525 | 7.219131 | 4.650730 | 0.0000\* |
| D(INF) | 28.751821 | 8.675961 | 4.875302 | 0.0000\* |
| D(UNPL) | -28.639401 | 8.394091 | -5.365091 | 0.0000\* |
| D(INP) | 1.494065 | 0.232059 | 6.438286 | 0.0000\* |
| CointEq(-1) | -0.010698 | 0.001171 | -9.133698 | 0.0000\* |
|  |  |  |  |  |
|  |  |  |  |  |
| Long Run Coefficients | | | | |
|  |  |  |  |  |
|  |  |  |  |  |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
|  |  |  |  |  |
|  |  |  |  |  |
| ELC | 2.890612 | 0.257562 | 3.522640 | 0.0004\* |
| INF | 2.926642 | 0.676351 | 4.246022 | 0.0000\* |
| UNPL | -4.275013 | 2.064876 | -2.151662 | 0.0159\*\* |
| INP | 7.717521 | 3.342125 | 3.335850 | 0.0202\*\* |
|  |  |  |  |  |

\*&\*\* indicate *statistically significance at 1% and 5% level*

**Source:** Author’s Computation, 2023.

**4.3. Diagnostic Checks**

To determine the appropriateness and adequacy of ARDL model, the study conducts some robust diagnostic tests; this includes serial correlation test, heteroscedasticity test, misspecification of the model test as well as normality tests and parameter stability tests. After estimated the ARDL regression, the next step is to determine the appropriateness of ARDL model, the study conducts some diagnostic tests (e.g., serial correlation, heteroscedasticity and normality tests) and parameter stability test in order to examines the “independence” of the residuals in the ARDL model by employing the “Harvey Heteroskedasticity Test” to test for Heteroskedasticity problems, the “Breusch–Godfrey Serial Correlation LM Test” to test for serial correlation, the “Ramsey Test” to test for equation misspecification and the “Jarque–Bera Test” to test for normality of the variables. Evidence from Table 4 reveals that the residuals in ARDL model have no Heteroskedasticity problems, exhibits no serial correlation, no misspecification (i.e. in its functional form), and are normally distributed. These tests show in table 4 and figure 2 below.

**Table 4 Post Estimation Test**

|  |  |  |  |
| --- | --- | --- | --- |
| **Diagnostics Check** | **F- STATISTIC** | **Prob.** | **Null Hypotheses** |
| Harvey Heteroskedasticity Test | 1.560597 | 0.1862 | No Heteroskedasticity |
| Breusch-Godfrey Serial Correlation LM Test | 1.489113 | 0.2450 | No Serial correlation |
| Ramsey RESET Specification Test | 1.380772 | 0.1812 | No specification error |

**Source:** Author's Computation, 2023.

**Figure 2 Normality Test**



**Source:** Author's Computation, 2023

**4.4. Stability Checks**

In order to check the stability and adequacy of the ARDL approach, the research analyses the reliability of the cointegration by using Cumulative sum of recursive residuals (CUSUM) and cumulative sum of squares of recursive residuals (CUSUMSQ) Tests. As mentioned in the methodology the cumulative sum (CUSUMSQ) test is used to test the randomness of a sequence of zeros and ones (Data plot to convert a data set with exactly two distinct values to a sequence of zeros and ones). For this test the zeros to negative ones. The test is based on the maximum distance from zero of a random walk defined by the cumulative sum of the sequence. A large enough distance is indicative of non-randomness while cumulative sum of squares (CUSUMSQ) tests is based on the recursive regression residuals

Result from Figure 3 reveals that, both CUSUM and CUSUM of squares are within the 5% significance level; thus, ARDL model is robust and stable and adequate in its form.

**Figure 3 Stability Checks**



**Source:** Author’s Computation, 2023.

**5. Conclusion and Recommendation**

This paper investigated the causal relationship between electricity consumption and economic growth in Nigeria by employing the ARDL bounds testing procedure to identify the long run equilibrium relationship.

1. The study appoints electricity consumption, industrial production, inflation rate and employment as intermittent variables to form a multivariate framework covering the period between 1996 and 2021.The results from the ARDL bounds test reveal that there is existence of a long run relationship between economic growth, electricity consumption, industrial product, inflation rate and unemployment. The coefficients on electricity consumption, Industrial Product and inflation rate are positive and significant, meaning that an increase in these variables boosts economic growth. On contrary, the coefficient Unemployment is negative and significant meaning that unemployment retard economic growth in Nigeria.
2. Based on the findings, the paper recommends that, government should undertake serious measures to curtail the shortage of electricity consumption in the country in order to promote economic growth in general. Order adopting such policy should introduce other sources of energy in the country where it necessarily need to be address.
3. More so, the government should adopt appropriate policy that will reduce the level of unemployment which has adverse effect on economic growth. Similarly, the should encourage other means of energy both private and public in the country, so that, the energy problem need to be address fully in the economy .

**REFERENCES**

1. Agbede, E. A., Bani, Y., Azman-Saini, W. N., & Naseem, N. A. (2021). The impact of energy

consumption on environmental quality: empirical evidence from the MINT

countries. *Environmental Science and Pollution Research*, *28*(38), 54117-54136.

1. Audu, E., Paul, S. O., &Ameh, A. (2017). Privatization of power sector and poverty of power

supply in Nigeria: A policy analysis. *International Journal of Development and*

*Sustainability*, *6*(10), 1218-1231.

1. Emodi, N. V., Emodi, C. C., Murthy, G. P., &Emodi, A. S. A. (2017). Energy policy for low

carbon development in Nigeria: A LEAP model application. *Renewable and Sustainable*

*Energy Reviews*, *68*, 247-261.

1. Imam, M. I., Jamasb, T., &Llorca, M. (2019). Sector reforms and institutional corruption:

Evidence from electricity industry in Sub-Saharan Africa. *Energy Policy*, *129*, 532-545.

1. Iorember, P. T., & John, E. (2016). Commercial bank credit and manufacturing sector output in

Nigeria. *Journal of Economics and Sustainable Development*, *7*(16).

1. Khobai, H., Mugano, G., & Le Roux, P. (2017). The impact of electricity price on economic

growth in South Africa. *International Journal of Energy Economics and Policy*, *7*(1), 108-

116.

1. Nathaniel, S. P., &Bekun, F. V. (2020). Environmental management amidst energy use,

urbanization, trade openness, and deforestation: The Nigerian experience. *Journal of Public*

*Affairs*, *20*(2), e2037.

1. Nathaniel, S. P., &Bekun, F. V. (2021). Electricity consumption, urbanization, and economic

growth in Nigeria: New insights from combined cointegration amidst structural

breaks. *Journal of Public Affairs*, *21*(1), e2102.

1. Nkalo, U. K., &Agwu, E. O. (2019). Review of the impact of electricity supply on economic

growth: A Nigerian case study. *IOSR Journal of Electrical and Electronics*

*Engineering*, *14*(1), 28-34.

1. Oates, W. E. (1985). *On the nature and measurement of fiscal illusion: A survey*. College Park,

MD: Department of Economics, University of Maryland.

1. Ologundudu, M. M. (2014). The Epileptic Nature of Electricity Supply and its Consequences on

Industrial and Economic Performance in Nigeria (Error Correction Model

approach. *Global Journal of Research in Engineering*.

1. Ologundudu, M. M. (2015). The impact of electricity supply on industrial and economic performance in Nigeria. *International Global Journal of Management and Business*

*Research*, *2*(4), 9-28.

1. Olufemi, O. J. (2015). The effects of electricity consumption on industrial growth in Nigeria.

*Energy*, *6*(13), 54-59.

1. Osobase, A. O., & Bakare, A. T. (2014). The nexus between electricity generation, supply and

manufacturing sector performance in Nigeria (1975-2011). *International Journal of*

*Management Sciences and Humanities*, *2*(2), 123-139.

1. Oyeyemi, A. M. (2018). Disaggregate energy supply and industrial output in Nigeria. *International Journal of Economics, Business and Management Research*, *2*(2), 154-172.
2. Salmon, C., & Tanguy, J. (2016). Rural electrification and household labor supply: Evidence from Nigeria. *World development*, *82*, 48-68.
3. Sankaran, A., Kumar, S., Arjun, K., & Das, M. (2019). Estimating the causal relationship between electricity consumption and industrial output: ARDL bounds and Toda-Yamamoto approaches for ten late industrialized countries. *Heliyon*, *5*(6), e01904.