IMPLICATIONS OF ENVIRONMENTAL TAX ON PERFORMANCE OF ELECTRICITY GENERATION FIRMS IN NIGERIA: A FOCUS ON AFAM POWER LIMITED

Nwogo Justin E.
Department of Banking and Finance, Ebonyi State University, Abakaliki
Corresponding Author: nwogojusty@gmail.com

Abstract

This study examined the implications of environmental tax on the performance of electricity generation firms in Nigeria a study of Afam power limited. The specific objectives were: to determine the implication of carbon emission tax; to ascertain the implication of electricity value added tax, and to evaluate the effect of Petroleum Profit Tax on the performance of Afam Power Limited. The ex post facto research was adopted, and secondary data on the total assets (dependent variable), carbon emission tax, and electricity value added tax. The study employed the ordinary last squares technique (OLS) to analyze the data. The results showed evidence of negative correlation between environmental taxation and the performance of Afam Power Limited. The major findings of the study indicated that carbon emission taxes had significant negative impact on the performance of electricity generatingfirms in Nigeria; electricity value added tax has significant negative effect on the performance of electricity generatingfirms in Nigeria; and petroleum profit tax has significant negative effect on the performance of electricity generating firms in Nigeria. The study concluded that environmental tax had significant negative implication on the performance of electricity generating firms in Nigeria for the period reviewed. Based on the findings, the study therefore recommended that policymakers should design a strategy toward reexamining the carbon emission taxes due to evidence of negative shock on the performance of the electricity generating companies; the electricity value added tax should be removed or significantly reduced, this will mitigate reduction in electricity consumer demand arising from increase is price that is traced to electricity value added tax; and the petroleum profit tax may also need to be reviewed as there is interconnectedness of energy firms, the electricity generation companies and the electricity distribution companies.

Keywords: Environmental Tax, Petroleum Profit Tax, Electricity Generation Firms, Afam Power Limited.

Introduction

A significant percentage of the energy generated in Nigeria today comes from gas-fired power plants whose key stock-in-trade (natural gas) is liable to value added tax (NERC, 2023). The generation sub-sector presently includes 23 grid-connected generating plants in operation with a total installed capacity of 10,396 MW (available capacity of 6,056 MW) with thermal based generation having an installed capacity of 8,457.6MW (available capacity of 4,996 MW) and hydropower having 1,938.4 MW of total installed capacity with an available capacity of 1,060 MW. This comprises of the privatized GenCos, Independent Power Producers (IPPs) and the generating stations under the National Integrated Power Project (NIPP).In 2005, as a result of the power sector reform process, the National Electricity Power Authority (NEPA) was unbundled and renamed Power Holding Company of Nigeria (PHCN). The Electric Power Sector Reform (EPSR) Act was signed into law in March 2005, enabling private companies to participate in electricity generation, transmission, and distribution. The government unbundled PHCN into eleven electricity distribution companies (DisCos), six generating companies (GenCos), and a transmission company (TCN). The Act also created the Nigerian Electricity Regulatory

Commission (NERC) as an independent regulator for the sector. At present, the Federal Government has fully divested its interest in the six GenCos while 60% of its shares in the eleven (11) DisCos have been sold to the private operators. The Transmission Company still remains under government ownership.

Afam Power PLC is one of the Generation companies that were fully privatized while government still maintains up to 40% share in others. Afam Power Plc operated as a power generation company. The Company owns, operates, and manages thermal power plants. Afam Power serves customers in Nigeria. Afam Power PLC is a premier thermal Power Generating Company Located in Oyigbo LGA of Rivers State Nigeria. The Plant initially had an installed capacity of 776 megawatts of electricity. It is an open cycle gas turbine plant and was commissioned in phases between 1962 and 2001.In 2023, the Transcorp Power consortium acquired the Afam Power Plc and it became fully privatized under the name Trans-Afam Power Limited. The company has an installed electricity generating capacity of 966 megawatts.

Taxing electricity generating firmsindiscriminatelymay bring detrimental effect on electricity generation, electricity consumer demands, jobs, competitiveness and the economy. Creating new environmental taxes may be counterproductive since multiplicity of taxes is still a business competitiveness issue for Nigeria (Afolabi, 2020). A better approach according to him should be to review and plug identified gaps in the environmental regulatory landscape (including stringent financial sanctions), and strengthen relevant agencies to enhance enforcement capacity. Environmental issues are at the top of government agenda, alongside safety and security. The government of Nigeria recognizes the need to address the global challenges of climate change and has adopted a set of ambitious environmental targets to mitigate carbon emissions from electricity and other carbon firms, including average improvement in fuel efficiency per year, cap on net carbon emissions, etc. In addition to its climate change action, Adetutu, Odusanya, and Weyman-Jones (2020) stated that the government is also engaged in efforts to mitigate its impacts on the local environment and is working with competent authorities to find measures to address infrastructure obstruction (by electricity companies building of high tension grids), noise and air quality problems.

Electricity generating firms strongly oppose any form of national or sub-national environmental scheme that appear to be multiple and extra-territorial taxation of electricity firms as this would negatively affect the performance of electricity distribution companies. According to Ajayi and Reiner (2020), any market-based measure (MBM) applied to electricity distribution companies must be global in scope, preserve fair competition, and take account of different types and levels of operator activity. The safe, orderly and efficient functioning of electricity distribution firms relies on a high degree of uniformity in regulations, standards and procedures. The use of unilateral measures such as taxation undermines this. A wide cross-section of the economy is impacted by the imposition of an environment tax, including: electricity generating firms, manufacturing industries, homes and offices. In general, electricity has a high price elasticity of demand i.e., is highly sensitive to changes in price (Alola & Ulrich, 2021). The imposition of an additional form of taxation on the firms, in addition to the existing taxes, fees and charges already leviedon electricity generating companies, means the overall electricity consumption and the financial performance of the firms is negatively impacted as observed by studies.

Electricity consumers (industries and homes) may choose not to purchaseor drastically reduce electricity consumption as a result of the price increase which will accompany additional tax, may substitute other means of energy (i.e., Solar, Generators, etc.) or may attempt to divert electricity demand to other places where such a tax has not been levied, all of which reduces productivity and may result in displacing environmental problems to other locations. Aydin and Turan (2020) suggested that manufacturing firms are negatively affected due to difficulties in production as a result of rise in the price of electricity which

implies an increase in the cost of production. The price elastic nature of electricity means that the increase in tax revenue derived from an environmental tax may be outweighed by the greater proportional decrease in the electricity consumption and the resulting reduction in revenue from lost electricity consumers' spending. Consequently, while the overall goal of an environmental tax is laudable, its distortionary effect on firms' performance, jobs and the economy, makes it a bad policy choice.

By 2032, if forecasts are accurate, there will be over 94 millionelectricity consumers and electricity will support more than 103 million jobs billions of Naira in economic activity (Bashir, Benjiang, Shahbaz, Jiao &Xue, 2020). Taxation measures (such as an environmental tax) that increase the electricity distribution will have a negative impact on these forecasts and the resulting economic benefits for the nation.There are two major types of environmental taxes in Nigeria (KPMG, 2022). These include carbon emission tax, obstruction tax; and sometimes petroleum profit tax is also classified as environmental tax as it relates to carbon and energy activities. The electricity generation and distribution companies are classed under firms liable to carbon emission tax. Carbon taxes are environmental taxes levied on precise units of carbon (or a proxy) by governments to reduce carbon emissions (through fossil-fuel-based energy) which occur as a result of the production or consumption of goods and services. Nigeria's National Council on Climate Change formulated national carbon tax policy. Under the carbon tax system, the government will set a price for emitters to pay for each ton of emissions, and helping raise revenues and reduce emissions. Carbon-pricing schemes, such as the EU's Emissions Trading System, are considered an effective and economic way to reduce greenhouse gas emissions. Nigeria, Africa's largest oil producer, has committed to achieve net-zero carbon emissions by 2060 while underlining the importance of gas as a transition fuel. This comes as many in the carbon and renewables industry are looking to Africa as a huge growth market.

In 2012, amidst an effort to promote low-carbon emissions and respond to the impacts of climate change, such as extreme weather events, droughts, floods, and food insecurity among others, Nigeria introduced the Nigeria Climate Change Policy Response and Strategy (NCCPRS).In 2021, Nigeria's Environment Ministry through its Department of Climate Change introduced the National Climate Change Policy (NCCP) for the 2021 to 2030 period. The NCCP sets out Nigeria's climate change policy direction, addressing conditions required to attain Nigeria's vision to be a climate-resilient economy. In 2022, the Climate Change Act, 2021 (the Act) passed by the National Assembly in October 2021 was signed into law. The Act provides a framework for achieving low GreenHouse Gas (GHG) emissions and to mainstream climate change actions into national plans and programs.

Studies on the relationship between environmental taxes and electricity generation are novel and relatively emerging. Carbon taxes, levied on coal, oil products, and natural gas in proportion to their carbon content, can be collected from gas and fuel suppliers. Researchers posit that they in turn will pass on the tax in the form of higher prices for electricity, gasoline, heating oil, and so on, as well as for the products and services that depend on them. The increase in electricity prices creates difficult marketing and supply strain for the distribution companies and overall affect their financial performance. In Nigeria, electricity consumers have complained of constant increases in electricity tariffs which is gradually becoming short of their reach. Hence this study aims to investigate the implications of environmental tax on the performance of electricity generating companies in Nigeria

Statement of the Problem

The effect of imposition of environmental tax on electricity generating firms is like a chain. First, imposition of the tax increases generation cost, the increase in generating cost sprirals to the distribution companies, then an increase in electricity cost. Consumers are not always fine with increasing costs; hence they will rationally reduce or avoid consumption due to increased process. A reduction in electricity consumption will drastically affect the financial performance of the generating firms by way of low uptake of generated electricity units by the Discos, reduced sales and profits. This is the biggest problem facing electricity generating companies in Nigeria (Adetutu, Odusanya &Weyman-Jones, 2020). For instance, out of its 1, 315,388 million customers, only about 49% were actively as at October 2022, a reduction from 61% as at September 2021 (EEDC, 2022). This fall in active electricity consumption was attributed to the hike in electricity tariffs implemented by the distribution companies to cover for increased production costs exerted on the units by the generating companies.

High taxes on high carbon emitters such as energy and utility (electricity) generating companies have been projected to see their share prices drop. Such drop in prices will further heighten investors growing concern regarding impacts on their investment decision making. Energy and electricity generating companies in Nigeria have been on the decrease due to unsustainable tax scheme which hampers business performance and consequently produce significant impacts on the stock market performances. Some oil and gas firms avoid or evade tax. These companies that avoid or evade tax argue that the environmental taxation schemes such as petroleum profit tax and carbon emission taxes have a huge impact on their profitability due to the high tax rate charged on assessable profit. Ilaboya and Ofiafor (2020), opines that the increase in tax evasion by oil and carbon related firms is anchored on their argument that the taxes hampers their performance.

A significant percentage of the energy generated in Nigeria today comes from gas-fired power plants whose key stock-in-trade i.e. natural gas, is liable to VAT. Generating Companies (Gencos) should therefore be able to recover the VAT paid to gas suppliers from that collected on energy sold (a new product) to the Distribution Companies (Discos) or to the bulk trader, the Nigeria Bulk Electricity Trading Company (NBET). The Discos should also be able to recover the input VAT paid to the electricity generation (Gencos) from that collected from customers. Consequently, VAT should not be an extra burden for the industry as all players are able to transfer that cost to the final consumer. However, this is not the case. Poor collection rate is still a significant issue for Discos that may struggle to recover any VAT paid. This will also have a knock-on effect on the value chain as Discos that have struggled to pay for power taken may not be able to pay any VAT charged by the Gencos; thus limiting the Genco's ability to recover the VAT paid to gas suppliers. The broad objective of this study is to examine the implications of environmental taxation on the performance of electricity generation firms in Nigeria (a study of Afam power limited). The specific objectives are:

1. To determine the implication of carbon emission tax on the performance of Afam Power Limited
2. To ascertain the implication of electricity value added tax on the performance of Afam Power Limited
3. To evaluate the effect of Petroleum Profit Tax on the performance of Afam Power Limited.

Literature Review

Tax

Tax is defined as a financial charge or levy imposed upon an individual or legal entity by a State or a legal entity of a State; it is a pecuniary burden laid upon individuals or property to support government expenditure. It also defined tax as a monetary charge imposed by the Government on persons, entities, transactions or properties to yield revenue. It went further to state that tax is the enforced proportional contributions from persons and property, levied by the State by virtue of its sovereignty for the support of Government and the public needs (National Tax Policy, 2013; Adegbile & Fakile, 2016). According to Musgrave (2004), tax plays an important role in Nigeria society and it is a force for economic development in the country, from the pre-colonial to the post-colonial eras. It is by far the most significant sources of revenue for modern government; hence, the recent call for increase in taxation.

Environmental Tax

Carattini (2017) defined environmental taxes as excise taxes on environmental contaminants or on goods and services whose use contributes to pollution. Green taxes, also known as environmental, pollution, eco and carbon taxes, are meant to advance the environment. Environmental taxation is of great importance in environmental policies. The taxation is used mainly to discourage negative impact on the environment which occurs from the activities of businesses. Due to the dangers of global warming, corporations, governments, and consumers among other stakeholders are becoming aware of the impact of business activities on the environment. Since 1990s, environmental taxation has been applied in changing the burden of taxation from growth-oriented factors to help in reducing the depletion of natural resources and pollution (Andreoni, 2019). It has been established (see Wu, Xiao,Liu. and Zhang (2020) that human activities particularly carbon emission, burning of fossil fuels, and land use change can influence stock market investment and investors; and the stock market managers and participants will always seek to know the magnitude at which such activities and the related policy leanings can impact on the stock market. The investors 'perceptions about their investments and the future performance of the stock market as whole tend to erupt volatility in the stock market. Stock market volatility has also been traced to variations in the regulatory standard (tax policies) in such areas as carbon emission, changes in physical climate factors such as severe climate conditions attributed to the activities of carbon firms. The variations in these activities and the effect on the environments triggers regulatory policies with the tool of taxation and ultimately create a volatile environment in the stock market (Matsumura, 2014).

Carbon Emission Tax

Carbon emissions refer to the release of CO2 from burning oil, coal, natural gas and waste materials for energy use. Carbon dioxide also enters the atmosphere from deforestation and from some industrial processes such as cement production. However, emissions of carbon from these other sources represent a smaller share of global emissions. These emissions estimates are affected by the quality of the underlying energy data. Carbon emission taxes refer to taxes levied on coal, oil products, and natural gas in proportion to their carbon content. The carbon tax is a major instrument for curbing greenhouse gas emissions that cause global warming. They are collected from fuel suppliers who in turn pass on the tax in the form of higher prices for electricity, gasoline, heating oil, etc, as well as for the products and services that depend on them.

Electricity Value Added Tax

Electricity Value Added Tax (E-VAT) is a tax charged on the distribution and sale of electricity at every point of distribution and consumption and is usually included in the price. VAT is a tax on consumer spending, so everyone who pays for goods and services pays VAT. It is built into the cost of many commonly consumed items such as clothing and petrol, so you don't see what percentage of VAT you are paying. However, when you are buying some items or services, such as electricity and professional services, you may see the amount of VAT and the rate at which you are being charged on your bill.

Nigeria's VAT Act provides for input VAT to be recovered against output VAT, only when incurred on stock-in-trade used in the direct production of a new product or on goods purchased for re-sale. A significant percentage of the energy generated in Nigeria today comes from gasfired power plants whose key stock-in-trade i.e. natural gas, is liable to VAT. Generating Companies (Gencos) should therefore be able to recover the VAT paid to gas suppliers from that collected on energy sold (a new product) to the Distribution Companies (Discos) or to the bulk trader, the Nigeria Bulk Electricity Trading Company (NBET). The Discos should also be able to recover the input VAT paid to the Gencos (or NBET) from that collected from customers.

Consequently, VAT should not be an extra burden for the industry as all players are able to transfer that cost to the final consumer (transmission/ wheeling charges do not qualify for input VAT recovery). However, this is not the case. Poor collection rate is still a significant issue for Discos that may struggle to recover any VAT paid. This will also have a knock-on effect on the value chain as Discos that have struggled to pay for power taken may not be able to pay any VAT charged by the Gencos; thus limiting the Genco's ability to recover the VAT paid to gas suppliers. This ultimately worsens the liquidity issue.

Petroleum Profit tax

The Petroleum Profits Tax Act requires all companies engaged in the extraction and transportation of petroleum products to pay tax. It is particularly related to rents, royalties, margins, and profit-sharing elements associated with oil mining, prospecting, and exploration leases. Oil-producing companies are liable to tax under the Petroleum Profit Tax Act CAP P13 LFN 2004 at the following rates: Joint Venture Contracts, Risks Service Contracts and Sales Risk Operations – First Five years 65.75 percent; subsequently 85 percent; production Sharing Contract (PSCs) – 50 percent of chargeable profit (mainly for deep off-shore exploration and production). Petroleum Profit Tax has been defined as legislation that imposes a tax upon profits from the mining of petroleum in Nigeria and provides for the assessment and collection thereof and the purposes connected therewith (Attamah, 2004).

Xin and Tang (2022) estimated the impact of industrial tax policy on electricity firms performance. The study exploited the VAT preferential policies for enterprises in the power industry issued by the Chinese government since 2013. They employed ordinary least squares regression technique to analyze the panel data for 5 energy companies. They found that, compared with traditional power generation technology-oriented enterprises, the enterprises in the power industry dominated by green energy technology slowed performance after the launch of the environmental tax policy, which is reflected in significant decrease in the gross profits and net profits. The findings of this the study suggest that random and target tax policies are not helpful to enterprises, and shed light on the industrial structure transformation of power industry enterprises.

Aza and Daniel (2021) study examines the effect of petroleum profit tax in Nigeria covering a period of 36 years ranging from the year 1985 – 2020. Secondary data were collected from the Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics (NBS), Federal Inland Revenue Service (FIRS), and Organization for Economic Cooperation and Development (OECD) for the period 1985 - 2020. The data were analyzed using multiple regression techniques. Findings reveal the tax revenue exerts a positive and significant effect on public expenditure in Nigeria. In addition, the F-test and coefficient determination discloses that the models of the study were significant in explaining the relationship between the dependent and independent variables which were captured by CE and PPT. The study, therefore concluded that; tax revenue has a significantly positive impact on public expenditure and by extension on public sector financial management and does substantially reduce the inefficiencies associated with the budgetary frameworks, particularly in the agricultural sector in Nigeria.

Bolton and Kacperczyk (2021) examined the effect of firms' carbon emissions on the cross-sectional pattern of stock returns. The study used the ordinary least square regression analysis (OLS) to estimate the model using time series data. The study found that stock market all share index responded negatively to carbon emission taxes and solid mineral mining taxes but responded positively to the green bond variable. The study recommended a balanced climate change mitigation action by government in area of reviewing the extant carbon tax laws.

Choi, Gao, and Jiang (2020) researched on the impact of carbon mitigation policies on the performance of firms. The study found evidence that carbon-intensive firms underperform others with low emissions during the period of abnormally high local temperature, and when investors' attention to global warming also increases. However, some studies have expressed their concerns about the prospective inefficiencies of the market.

Adetutu, Odusanya and Weyman-Jones (2020) examined the impact of environmental taxes on energy consumption and energy intensity using panel data covering the period 1995–2019 from 35 OECD countries. I employed environmental tax to total tax ratio, total energy consumption, and total energy intensity to estimate the relation between energy consumption and environmental taxes. Using the fully modified and dynamic OLS techniques and I showed that environmental taxes have a negative effect on energy consumption and energy intensity in the long run. Furthermore, using the Dumitrescu and Hurlin's panel granger causality test the study found a bi-directional long-run causality between environmental taxes and energy consumption and intensity. With regards to the disaggregated effect of environmental taxes, this study found that energy taxes (including CO2 taxes) have a larger effect on energy consumption and energy intensity than pollution and transport taxes. It was concluded that environmental taxes have a significant impact on energy consumption and energy intensity among OECD member countries.

Theoretical Framework

The theoretical framework adopted for this study is the Political Economy theory. This theory was propounded by Jevons in 1871. Political economy is the study of production and trades and how it is influence by law, custom and government. Political economy theory has been the most widely used theory to explain why organizations seem to yield to government or public pressure for the disclosure of information about the impact of their operations within and without the communities in which they operate (Liu &Anbumozhi, 2009; Deegan, 2002; Cormier & Gordon, 2001; Gutherie & Parker, 1990; Dowling & Pfeffer, 1975). Political economy theory has been used to explain the disclosure of social and environmental information by corporate organizations (Deegan &Unerman, 2006).

The theory supposes that organizational outcomes (such as energy firm's performance) could be explained by environmental information (environmental tax) where law and regulatory framework are applied to achieve certain economic, social and environmental objectives. The basic model of the political economy theory sees production as a function of environmental information. The production performance function of an economic unit could therefore take the form below:

Output = f(L, C, Ei, G)

Where: L = law, C= custom, Ei = environmental information, G = government. In relation to the environmental tax and electricity company performance nexus, the theory of political economy could therefore appropriately be applied explain how environmental information (tax) could trigger directional changes in the performance of the energy firms.

This study is unique in because the researcher employed micro analysis and explored total environmental tax, electricity value added tax and petroleum profit tax in relation to the performance of a specific energy company which is scarce in the domestic literature. The researcher also conducted a number of robustness procedures that have rarely been used in previous studies. Thus, in this study, the researcher focused on the impact of environmental taxes on electricity Distribution Company in Nigeria (EEDC). This study is similar to studies such as Aydin and Esen (2018), Morley (2012), Bashir (2021) and Sebastian, Miller and Mauricio (2013). Despite the similarities in terms of variables and methodology, there are still some differences worthy of note. This study differs in two ways from the study conducted by Bashir (2021). In terms of objectives, this study sought to examine total environmental taxes and energy consumption and explore the impact of disaggregated environmental taxes on energy distribution company performance. In terms of methodology, this study is quantitative and employed secondary (time series) data whereas other studies were qualitative.

Methodology

Sources of Data

The data used for the study were sourced from the CBN statistical bulletin, the Nigerian Stock Exchange annual reports, and the Nigeria extractive industry transparency initiative (NEITI) reports. The data are time series data on carbon emission taxes (proxy by petroleum profit taxes) solid mineral mining taxes, and the federal government green bond. The data covers the period 1991-2022. The scope of this study centers on environmental tax and electricity generating firm's performance. The topic and geographical scope center on Afam Power Limited in Nigeria. The time scope is 2010-2022. The variables of study include carbon emission tax and electricity value added tax as components of environmental tax. This scope was chosen to capture the performance of the firms before its acquisition by the Trancorp Power Consortium in 2023. The research design adopted for this study is the *ex post facto.* This choice of this design is due to its suitability in forecasting time series variables. In this design, the use of past values to explain future outcomes is made possible. The processes to be followed will begin with the unit root test of stationarity, followed by the test for co-integration using the Johansen approach and then the ordinary least squares analysis.

Model Specification

This study adopted the model by xin and Tang (2022) which was used to assess the effect of carbon emission tax on firms performance. however, since the model did not include electricity value added tax, this study modified it by adding electricity value added tax and petroleum profit tax, modified as follows:

Functionally, the model is specified below:

TAS = (CET, EVAT, PPT) … 1

Where:TAS = total assets, CET = carbon emission tax, EVAT = electricity value added tax, PPT = petroleum profit tax

The linearized (econometric) model is specified thus

$TAS = \beta 0 + \beta 1CET + \beta 2IPPT + \beta 3EVAT + Ut \ldots 2$

Where β1, β2, β3 and β4 are the estimated coefficients of the of the green taxation variables of carbon emission, solid mineral mining taxes, industrial pollution tax and the monetary policy rate

Description of Research variables

Total Assets (TAS): refers to the sum of the book values of all assets owned by an individual, company, or organization. It is a parameter that is often used as a performance indicator for a firm. The value of a company's total assets is obtained after accounting for depreciation associated with the assets.

Carbon emission tax (CET): Carbon emission tax is a type of penalty that businesses must pay for excessive greenhouse gas emissions. The tax is usually levied per ton of greenhouse gas emissions emitted. Carbon taxes, levied on coal, oil products, and natural gas in proportion to their carbon content, can be collected from fuel suppliers.

Petroleum profit tax (PPT):rents, royalties, margins, and profit-sharing elements associated with oil mining, prospecting, and exploration leases, gas and energy companies in Nigerua. Oil-producing companies are liable to tax under the Petroleum Profit Tax Act CAP P13 LFN 2004

Electricity value added tax (EVAT): is a tax charged on the distribution and sale of electricity at every point of distribution and consumption and is usually included in the price.Ochei (2010) defined value added tax as an indirect tax collected from someone other than the person who actually bears the cost of the tax

Results

Descriptive Statistics

The summary of the descriptive statistics from the data set is presented in table 1. From the table, average performance of the firm (Afam power Limited) in terms of total assets (TAS) was about 410.6525 billion naira for the period under review and the environmental tax variables (carbon emission taxes - CET, electricity value added taxes – EVAT, and the petroleum profit tax) averaged 88.84 billion naira, 54.42

billion naira, and 6487.188 billion naira respectively. These averages (mean values) show that there is high level of influence of environmental tax policies on the performance of electricity generating companies.

Table 1: Descriptive Statistics

	TAS	CET	EVAT	PPT
Mean	410.6525	88.84077	54.42854	6487.188
Std. Dev.	329.3261	35.54455	19.27311	1685.084
Skewness	0.382622	0.209370	0.176679	-0.188117
Kurtosis	1.685928	2.019899	2.047340	2.475724
Jarque-Bera	1.252541	0.615301	0.559229	0.225560
Probability	0.0134582	0.035172	0.006075	0.003347
Observations	13	13	13	13

Source: Author's computation 2023 (Eviews 10)

The result showed the model variables to be positively skewed except the petroleum profit tax variable which showed to be negatively skewed. The coefficients of the skewness were 0.38, 0.21, 0.18 and -0.19 the total asset (TAS – dependent variable), carbon emission tax (CET – independent variable), electricity value added tax (EVAT – independent variable), and petroleum profit tax (PPT – independent variable) respectively. The statistical result equally indicated that all the variables have a positive kurtosis; and wereplaykurtic (value less than 3). The Jarque-Bera normality test also accompanied the descriptive test. The probability result showed the error terms in all the variables are normally distributed. This is indicated by the p-values which are all less than the 5% level of significance (TAS, 0.01; CET, 0.03; EVAT, 0.00; and PPT 0.00; all < 0.05). The normality test as indicated by the Jarque-Bera Statistic was for the purpose of accomplishing a basic assumption of Ordinary Least Square (OLS) econometrics analysis. Although, other methods such as histogram of residuals or normal probability plot can also be used, the researcher chose Jarque-Bera due to the nature of the data used in the analysis. The result of the Jarque-Bera Normality test is also a component of the table 1 above. The normality test applies to the individual series to ensure that the data id suitable for the intended analysis. As a rule of thumb, if the p-value of Jarque-Bera statistics for each series (TAS, CET, EVAT, and PPT) is low, it implies that the data are normality distributed and suitable for the analysis and reliable for further estimation and forecasting purposes. Looking at the result in table 1 above, the p-value of the Jarque-Bera statistic for each of the series is considerably low (< 0.05), hence, the series are normally distributed and the model is fit for use.

Unit Root Test

Stationarity is important because many useful analytical tools and statistical tests and models rely on it. Unit root tests can be used to determine if trending data should be first differenced or regressed. Moreover, economic and finance theory often suggests the existence of long-run equilibrium relationships among non-stationary time series variables.It usually implies that the statistical properties of a time series (or rather the process generating it) do not change over time. Describing the underlying characteristics of the data collected on model variables are usually pre-estimation tests. The ADF unit root tests were conducted to verify the order of integration of each variable. Table 2provides the summarized results of the stationarity test; while tables 3 displayed the correlation matrix for the linear relationship test.

Table 2: Summary Result of Unit root Test of Stationarity
SERIES @ LEVELS

	ADF Stat	p-value	5% critical value	Order	Remark
TAS	-4.959674	0.0012	-3.875502	1(0)	Stationary
CET	-5.437040	0.0001	-3.875502	1(0)	Stationary
EVAT	-5.032316	0.0003	-3.875502	1(0)	Stationary
PPT	-4.841507	0.0005	-3.875502	1(0)	Stationary

Source: Researcher's computation 2023 (E-views)

The test for stationarity conducted using the Augmented Dickey Fuller Test (ADF) showedthat all the model variables were stationarity at levels, the ADF t-stat were greater than their 5% critical values, and the p-value less than (0.05) level of significance (column 3 and 4 of table 2). This makes it no longer necessary for a difference testing. Differencing is done when the data set failed to be stationary at level, stationarity is concluded if the ADF statistic is greater than the 5% critical value or if the probability value (P-value) is less than (0.05). Hence, stationarity and integration was achieved at order 1(0).

Correlation test

Correlation test was used to ascertain the strength and magnitude of the relationship between the dependent and independent variables and as a further test to analyse the electricity generating firm's performance through the key selected environmental taxation variables (carbon emission tax, electricity value added tax, and the petroleum profit tax), the correlation coefficients tables below portrayed serves to indicate the presence or absence of colinearity between the endogenous variable and exogenous variables. The result of the correlation test is presented in table 3 below.

Table 3: Correlation Matrix

	TAS	CET	EVAT	PPT
TAS	1.000000	0.974759	-0.265410	0.890161
CET	- 0.974759	1.000000	-0.194374	0.878711
EVAT	-0.265410	-0.194374	1.000000	-0.341078
PPT	-0.890161	0.878711	-0.341078	1.000000

Source: Author's Computation 2023 (Eviews10)

The correlation test result in table 3 above shows the correlation of the dependent variable (total asset – TAS)) and the independent variables (carbon emission taxes, electricity value added tax, and the petroleum profit tax). The relationship appeared negative for all the independent variables, indicating that environmental taxation has negative correlated with the performance of electricity distribution firms. The strength was highest in the carbon emission tax at 97.47%, followed by the petroleum profit tax at 89.02% and then the electricity value added tax at 26.54%.

Graphical Trend of the Model Variables
Trend of the Dependent Variable (Total Asset)

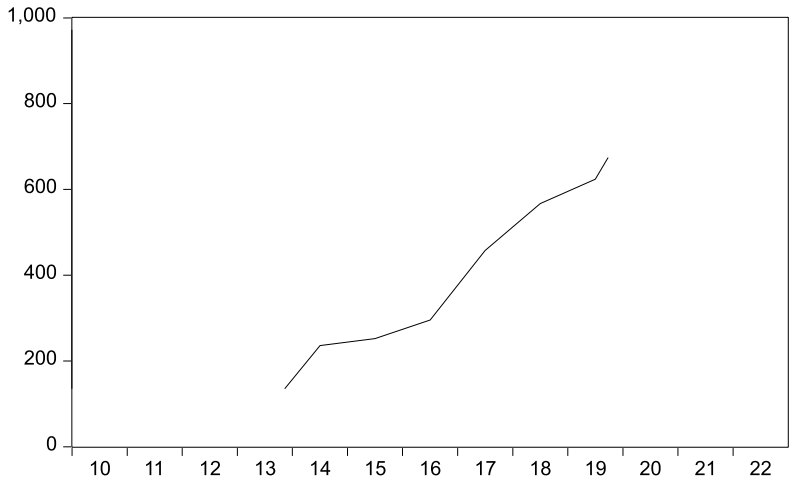

Figure 1: graphical trend of the total assets of Afam Power Limited from 2010-2022

From the figure above, the trend line indicate that the total assets of the Afam Power Limited has been increasing in the year 2010 the total asset of the company was a little below 200 billion naira. By the year 2022 it had increased to more than 800 billion naira. This shows that the firm has been improving in service delivery. The company has been acknowledged as one of the viable electricity generating companies since the unbundling of GENCOs by the federal government and the privatization of same.

4.4.2 Combined graphical Trend of the Environmental Taxation Variables

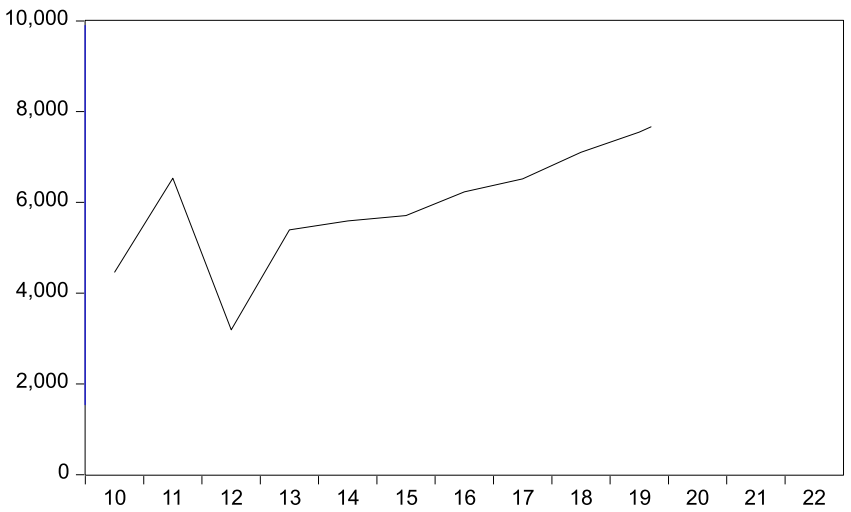

Figure 2: trend of the environmental taxation variables from 2010-2022

The figure 2 above showed the graphical trend of the environmental taxation (independent variables). The focus is the rate of increase of each of the variables overtime. It is indicated that the electricity value added tax had the highest rate of increase. This confirms the incessant increase in the electricity tariff rate which consumers have been crying about. The effect of the increase in the electricity value added tax is that it will have negative effect on the performance of the firm due to reduction in electricity consumer demand; as a result of increased tariff. From 2012, the electricity value added tax rate was relatively stable but increased minimally until about 2020 when the increase spiked up.

Estimation Result

Predicting the statistical significance between the endogenous variable (performance of Afam Power Limited) and the exogenous variables (environmental taxes: carbon emission tax, electricity value added tax and the petroleum profit tax), the study conducted ordinary least squares (OLS) regression estimates which aided in measuring the degree of impact on the predicted variable by the predictor variables. The OLS was adopted (following the order of integration of the variables at order 1(0)) to critically examine the effect of environmental taxation on electricity firms in Nigeria, study of EEDC.

Table 4: OLS Regression Estimates

Dependent Variable: TAS
Method: Least Squares
Sample: 2010 2022
Included observations: 13

Variable	Coefficient	Std. Error	t-Statistic	Prob.
CET	-9.650835	1.517775	-6.358540	0.0001
EVAT	-3.490247	1.050238	-3.323290	0.0077
PPT	-0.038346	0.824286	-2.578936	0.0154

R-squared	0.927738
Adjusted R-squared	0.913286
S.E. of regression	0.197763
Durbin-Watson stat	1.995843

Source: Researcher's computation 2023 (E-views 10)

From the OLS regression result (table 4), the following statistics are indicated; the coefficient of multiple determination (R^2), the standard error of the regression (SER) and Durbin-Watson (DW) statistics. The R^2 measures the overall goodness of fit of the regression plane; the higher the R^2, the better the goodness of fit. To pass the goodness of fit test, the coefficient of determination must have a value of at least fifty percent. The magnitude of the f-statistics is a test of the significance of the relationship between the dependent variable (financial performance) and the independent variables (environmental taxation variables – carbon emission tax, electricity value added tax, and the petroleum profit) taken as a whole,

while Durbin-Watson statistics is used to test for the first-order autocorrelation of the random variable. Because multiple regression model was used, the study also included the adjusted R^2 or coefficient of multiple regression.

From the results, the explanatory power of the model as informed by the adjusted R-square is ninety one percent (0.913286 or 91.33%), and is statistically significant given the low value of the standard error of regression (SER = 0.197763). To this end, the model demonstrates a good fit given that approximately 91% of the variation in the dependent variable (performance) is jointly explained by variations in the observed behaviour of the environmental taxation variables. The relatively high adjusted R-square shows that the model fits well.

In fitting a regression model to a dataset, the interest rest on how well the regression model "fits" the dataset. Two metrics commonly used to measure goodness-of-fit include R-squared (R2) and the standard error of the regression. The SE represents the average distance that the observed values fall from the regression line, and tells how wrong the regression model is on average using the units of the response variable. Smaller values are better because it indicates that the observations are closer to the fitted line. According to (Investopedia, 2023), in determining appropriate range of standard error, roughly 95% of the observation should fall within +/- two standard error of the regression, which is a quick approximation of a 95% prediction interval. From the result (table 4) the estimated standard error of regression is 0.197763, since this value falls within the +/-2 range, it implies that the environmental taxation variables would provide more precise predictions of the performance of the firms given the connectedness of the variables.

Conclusion and Recommendations

This study examined the effect of the implications of environmental taxation on the performance of electricity firms in Nigeria, a study of Afam Power Limited. The performance of the company being the dependent variable was proxy by the total assets of the company (TAS), while the environmental taxation was proxy by carbon emission taxes (CET), electricity value added tax (EVAT) and the petroleum profit tax (PPT). The study reviewed relevant literature and found gaps in terms of topic, geography, time and model specification of previous studies. The study adopted *ex post facto* research design and the ordinary least squares (OLS) technique to estimate the regression coefficients. From the results of the analysis, the model test of stationarity showed all the variables to be stationary at level and integrated of order 1(0). The descriptive and normality test indicated that the data was normal and fit for the intended analysis. The study found evidence of negative correlation among the model variables based on the correlation test result. From the regression result, the major findings of the study are: carbon emission taxes had significant negative impact on the performance of Afam Power Limited [coefficient - CET=-9.650835, p-value 0.0001]; the study found that electricity value added tax has significant negative effect negative impact on the performance of Afam Power Limited, [coefficient – EVAT = -3.490247, p-value = 0.0077]; and petroleum profit tax has significant negative effect on the performance of Afam Power Limited [Coefficient – PPT = -0.38346, p-value of 0.0154].Based on the findings, the study concluded that environmental taxation had significant negative implication on the performance of the electricity generation companies in Nigeria for the period reviewed. Following the findings, the study therefore recommended the followings; the policymakers should design a strategy toward reexamining the carbon emission taxes due to evidence of negative shock on the performance of the electricity distribution companies; the electricity value added tax should be removed or significantly reduced. This will mitigate reduction in electricity consumer demand arising from increase is price that is traced to electricity value

added tax; and the petroleum profit tax may also need to be reviewed as there is interconnectedness of energy firms, the electricity generation companies and the electricity distribution companies

References

Abdullah, S., & Morley, B. (2014). Environmental taxes and economic growth: evidence from panel causality tests. *Energy Economics, 42, 10.* https://doi.org/10.1016/j.eneco.2013.11.013

Adetutu, M., Odusanya, K., &Weyman-Jones, T. (2020). Carbon Tax and Energy Intensity: Assessing the Channels of Impact using UK Microdata. *The Energy Journal, 41. https://doi.org/10.5547/01956574.41.2. made*

Ajayi, V., & Reiner, D. (2020). European industrial energy intensity: innovation, environmental regulation, and price effects. *Energy Journal, 41(4).* https://doi.org/10.5547/01956574.41.4.vaja

Al-mulali, U., GholipourFereidouni, H., Lee, J. Y. M., &NormeeBintiChe Sab, C. (2013). Exploring the relationship between urbanization, energy consumption, and CO2 emissioni n MENA countries.*Renewable and Sustainable Energy Reviews, 23, 107–112. https://doi.org/10.1016/j.rser.2013.02.041*

Alola, A. A., & Ulrich Ti, D. (2021). Environmental Implication of Coal and Oil Energy Utilization in Turkey: Is the EKC Hypothesis Related to Energy?.*Management of Environmental Quality, 32(3), 543– 559.*https://doi.org/10.1108/MEQ-10-2020-0220

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies, 58 (2), 277.*https://doi.org/10.2307/2297968

Aydin, C., &Esen, Ö. (2018). Does the level of energy intensity matter in the effect of energy consumption on the growth of transition economies? Evidence from dynamic panel threshold analysis.*Energy Economics, 69, 185–195.* https://doi.org/10.1016/j.eneco.2017.11.010

Aydin, M., &Turan, E. Y. (2020). The influence of financial openness, trade openness, and energy intensity on ecological footprint: revisiting the environmental kuznets curve hypothesis for BRICS countries. *Environmental Science and Pollution Research International, 27(34), 43233–43245. https://doi.org/ 10.1007/s11356-020-10238-9*

Aza and Daniel (2021) Do environmental taxes affect energy consumption and energy intensity? An empirical analysis of OECD countries, Gideon Link Sackitey.*Cogent Economics & Finance (2023), 11: 2156094.References*

Bailey, I. (2002). European environmental taxes and charges: Economic theory and policy practice. *Applied Geography (Sevenoaks, England), 22(3), 235–251.*

Baltagi, B. H. (2005). Econometric Analysis of Panel Data (3rd ed.). John Wiley & Sons Inc. https://link.springer. com/content/pdf/10.1007/978-3-030-53953-5.pdf

Baltagi, B. H. (2005). Econometric Analysis of Panel Data (3rd Ed.).John Wiley & Sons. https://link.springer. com/content/pdf/10.1007/978-3-030-53953-5.pdf

Barro, R. J., & Xavier, S. (2003). Fifteen years of growth economics: What have we learnt?.

http://www2.econ. iastate.edu/tesfatsi/negrowth.salaimartin.pdf

Barro, R. J., & Xavier, S. (2003). Fifteen years of growth economics: What have we learnt?. http://www2.econ. iastate.edu/tesfatsi/negrowth.salaimartin.pdf

Basak, G., & Das, S. (2017). Intercept homogeneity test for fixed effect models under cross sectional dependence: Some insights. *Journal of Econometric Methods, 6(1).* https://doi.org/10.1515/jem-2015-0004

Bashir, M. F., Benjiang, M., Shahbaz, M., Jiao, Z., &Xue, B. (2020).The nexus between environmental tax and carbon emissions with the roles of environmental technology and financial development.*PloS One, 15 (11), 242-253*

Bashir, M. F., Benjiang, M., Shahbaz, M., Shahzad, U., &XuanVinh, V. (2021).Unveiling the heterogeneous impacts of environmental taxes on energy consumption and energy intensity: Empirical evidence from OECD countries.Energy (Oxford, England), 226 (120366), 120366.https://doi.org/10.1016/j.energy. 2021.120366

Bashir, M. F., Benjiang, M., Shahbaz, M., Shahzad, U., &XuanVinh, V. (2021). Unveiling the

Baum, C. F., Schaffer, M. E., &Stillman, S. (2003). Instrumental variables and GMM: Estimation and testing. *The Stata Journal, 3(1), 1–31.*

Baumann, F. (2008).Energy security as multidimensional concept. Centre for Applied Policy Research.

Baumann, F. (2008).Energy security as multidimensional concept. Centre for Applied Policy Research. Baumol, W. J., & Oates, W. E. (1988).Theory of environmental policy. Prentice Hall. https://doi.org/10.1017/ CBO9781139173513

Baumol, W. J., & Oates, W. E. (1988). The Theory of Environmental Policy (2nd ed.). Cambridge University Press. https://doi.org/10.1017/CBO9781139173513

Bellard, C. (2012). Impacts of climate change on the future of biodiversity. Ecology. https://doi.org/10.1016/j.rser.2015.10.080

Bilgili, F., Kocak, E., &Bulut, U. (2017). The dynamic impact of renewable energy consumption on CO2 emissions: A revisited environmental kuznets curve approach. *Renewable and Sustainable Energy Reviews, 54, 838–845.* https://doi.org/10.1016/j.rser.2015.10.080

Borozan, D. (2019). Unveiling the heterogeneous effect of energy taxes and income on residential energy consumption.*Energy Policy, (129), 13–22.*

Bozoklu, S., &Yilanci, V. (2013). Energy consumption and economic growth for selected OECD countries: Further evidence from the granger causality test in the frequency domain. *Energy Policy, 63, 877–881.".*https://doi.org/10.1016/j.enpol.2013.09.037

Burnett, J. W., &Madariaga, J. (2017).The convergence of US State-level energy intensity. Energy Econ, 62(357).https://doi.org/10.1016/j.rser.2015.10.080

Cadoret, I., &Padovano, F. (2016).The political drivers of renewable energies policies. Energy Economics, 56, 261–269. https://doi.org/10.1016/j.eneco.2016.03.003

CCICED (2019). "China's Green Prosperity Future – Environment, Energy and Economy".

http://www.cciced.net/cciceden/NEWSCENTER/CCICEDUpdate/2009n/201205/P020108104009361829 63.pdf. Accessed on 17 September,2021

Cetin, M., Ecevit, E., &GokhanYucel, A. (2018). The impact of economic growth, energy consumption, trade openness, and financial development on carbon emissions: empirical evidence from Turkey. *Environmental Science and Pollution Research International, 25(36), 36589–36603. https://doi.org/10.1007/s11356-018-3526-5*

Chang, S.-C.(2015). Effects of financial developments and income on energy consumption. *International Review of Economics & Finance, 35, 28–44.* https://doi.org/10.1016/j.iref.2014.08.011

Convery, F., McDonnell, S., & Ferreira, S. (2007).The most popular tax in Europe? Lessons from the Irish plastic bags levy. Environmental & Resource Economics, 38(1), 1–11. https://doi.org/10.1007/s10640-006-9059-2

Cosmo, D., Valeria, & Hyland, M. (2013).Carbon tax sce-narios and their effects on the Irish energy sector.*Energy Policy, 59, 404–414.* https://doi.org/10.1016/j. enpol.2013.03.055

Cottrell, J., Schlegelmilch, K., Runkel, M., & Mahler, A. (2016).Environmental tax reform in developing, emerging and transition economies.Studies, 93.https://www.idos research.de/uploads/media/Study_93.pdf

Deng, X., & Huang, H. (2020). Green Tax Policy, Environmental Decentralization and Energy Consumption: Evidence from China. Modern Economy, 11, 1528–1543. https://doi.org/10.4236/ me.2020.119109

Djula, B. (2019). Unveiling the heterogeneous effect of energy taxes and income on residential energy consumption.*Energy Policy, 129, 13–22*.

Dumitrescu, E.-I., &Hurlin, C. (2012).Testing for granger non-causality in heterogeneous panels. Economic Modeling, 29(4), 1450–1460.

Enache, C. A. (2020). Countries eye environmental taxation. Taxfoundation.Org. Tax Foundation. September 29, 2020. https://taxfoundation.org/countries-eyeenvironmental-taxation/