FACTORS AFFECTING HOUSEHOLDS' SATISFACTION WITH ELECTRICITY SUPPLY IN NIGERIA

Bukar Yakaka Maina,[1] Baba Gana Bukar,[2] Andrew Bamidele Egbedimame[3]

[1] *Department of Economics, Faculty of Social Sciences, University of Maiduguri, Nigeria*

[2] *Department of Agricultural Economics, Faculty of Agriculture, University of Maiduguri, Nigeria*

[3] *University of Maiduguri, Medical Centre, University of Maiduguri, Nigeria*

ABSTRACT

Electricity supply is an important factor in the socioeconomic development of any country. In spite of its importance to the household sector and the economic growth of Nigeria, not much investigation has been done on its service delivery. Thus, this study looks beyond connectivity to the factors affecting households' satisfaction with electricity supply. The study utilizes GHS data for 2019, which was analysed using a descriptive and logistic regression model. The results show that though 50% of households in Nigeria had access to electricity, only 25% had a prepaid meter. The reliability and duration of electricity in a day showed some variability due to variations in the hours of light in different areas in the country. Also, about 25% of households have had an issue with the quality of electricity while it takes days or even up to a week for PHCN staff to respond to health and safety issues. The mean monthly expenditure on electricity bills was ₦1,532. With regard to the logistic model, the result revealed that duration and quality of electricity supply were positively related to satisfaction at 1% respectively while on the contrary, reliability, health, safety and affordability were negatively related to satisfaction, but all were significant at 1%. In general, the majority of households in Nigeria (75%) are not satisfied with the services of PHCN. Thus, the study recommends that PHCN should enhance reliability by increasing the duration of electricity supply. Also, it should re-evaluate the monthly bills of households, improve

the quality of the electricity it supplies, and reduce the response time relating to health and safety issues.

JEL classification: I31, R2, Q2

1. Introduction

Energy from electricity sources is an important factor for the socio-economic development of any country. No economic activity can thrive nor individual lifestyle be improved without access to efficient electricity supply (Greenstone, 2014). This is because there is a causal relationship between efficient electricity supply and economic growth through the development of small-scale businesses (Khandker, Barnes & Samad, 2009).

In developing countries in the year 2000, there were about 1.65 billion individuals in the household sector who lacked access to electricity. However, in the year 2012, this number decreased to 1.28 billion increasing access rate for electrification increase to 64.2%, which further increased to 76% in 2014. This was indeed an encouraging rate for household electricity access across the world. (World Bank, 2014).

In Africa, a similar trend of increasing electricity supply and improved access has been observed even among countries with a small national income, such as Benin Republic. In 2013, Benin had a GDP of less than $40 billion but improved its access to 80% in 2017 as against 78% in 2013. A similar finding was reported for Ghana, which had a GDP of about $100 billion in 2015, and improved its access to electricity by 6.5% between 2014 and 2016 (Omolade, Nwosa & Amassoma, 2019).

However, the case is different for Nigeria despite being the largest economy in Africa with a GDP of $400 billion in 2019. All efforts made by successive governments in the past to improve access to electricity (Oladeji, 2014) have proved abortive, with the country still grappling with poor electricity supply (NERC, 2014). The problem affecting Nigeria is multifaceted. Initially, the country relied on hydro-based power plants but with increase in demand, gas plants were constructed to improve supply. However, despite this effort, electricity generation was still low; the plants were operating at inefficient levels due inadequate oil and gas supplies resulting from vandalization of oil/gas pipelines by saboteurs (NERC, 2016).

Moreover, access to power goes beyond just an efficient supply or power output of household grid connections to electrified households (Barnes, 2019). In Nigeria, households face limited hours of electricity supply, unstable voltage of electricity, and poor technical services (Omolade et al., 2019). Some of these issues are not considered in the country's national electricity billing rates even among households that use the prepaid meter as a reason to reduce their monthly bills. Although some households are charges on a pay as you consume basis, some of these problems go beyond just payment rates to the question of satisfaction (Aklin, Cheng, Urpelainen, Ganesan & Jain, 2016).

In order to determine the various indicators of electricity poverty through the duration of power supply and accessibility of efficient cooking energy sources, the International Energy Agency and some non-governmental organizations recommended what is called the Global Tracking Framework (GTF), which was launched by the World Bank and the United Nations under the Sustainable Energy for All Initiative. The framework ignores the classification of households into connected or not connected to electricity but instead measures access to electricity through a multi-tiered scale which includes affordability, capacity, voltage stability, reliability, legality, and health as well as safety aspects (World Bank, 2017).

Despite the importance of electricity to the household sector and the economic growth of Nigeria, not much investigation has been done on factors affecting satisfaction; most studies on electricity have dwelt on access to electricity supply. Thus, this study looks beyond connectivity, examining the various factors that determine the efficient quality of electricity supply based on households' satisfaction with electricity supply. This paper has two objectives: (i) to identify the major problems affecting consumers' satisfaction in the study area, and (ii) to determine the effect of the factors identified on consumers' satisfaction.

2. Literature Review

Consumer satisfaction is regarded as the experience of a consumer of a product over its services. If the ratings are high, some level of satisfaction is said to be achieved (Chiou & Spreng, 1996). Satisfaction is measured in subjective terms, varying from one consumer to the other, based on his/her psychological or physical satisfaction or both (Dave, 2009). Hence, perception is a useful tool

because it determines the level of consumer satisfaction (Hartman & Apaolaza-Ibanez, 2012). Thus, in the context of power supply, satisfaction deals with reliability, which is determined by how efficiently the electricity is supplied to meet the demand of consumers even when some unexpected technical issues or situations might decrease the rate of available power supply (Kenneth & Kay, 2014). Thus, it involves how the electricity company acts swiftly in the event of an unexpected power outage due to either natural or man-made factors. It also includes having the means to maintain adequate resources to provide consumers with sufficient power supply at an efficient voltage rate. Reliability also involves taking swift measures to address electricity shortages. However, it is hard to provide efficient power supply, thus power generating plants must be consistently regulated/monitored (Akaranga, 2014).

A study by Wakuru (2012) on the factors affecting consumers' satisfaction with Kenya's power supply revealed that the quality of services, marketing strategies, innovation, and capacity of employees are the factors that affect consumer satisfaction. The study found that the majority of the consumers reported that their expectations were met and the service was highly reliable. In the same vein, Akaranga (2014) examined the factors that influence consumer satisfaction with service provision in the same study area as above by Kenya Power Company among 384 respondents based on descriptive statistics. The results revealed that the power company was not reliable. Respondents complained of constant power outages at least once a month. They further added that the emergency teams do not respond in time to emergencies. Some reported that their electrical equipment had been damaged due to power surges.

Similarly, Anyomi (2014) assessed the impact of the quality of electricity supply on industrial performance in the Greater Accra region of Ghana. The study was based on descriptive statistics and the cross-sectional data set was obtained through the use of a questionnaire. It was administered to 10 broad categories of industrial owners, managers, heads of sections/supervisors, and engineers to examine their perception of the reliability of power supply. The results showed that there was a general dissatisfaction among consumers on the duration and the commercial quality of the electricity supplied. However, the level of the electricity voltage supply rate was a bit satisfactory to all the sampled organizations. Hence, it was concluded that there was a positive relationship between the rate of electricity supply and industrial performance.

With regard to households, Aklin et al. (2016) assessed the factors affecting household satisfaction with electricity supply in rural India using linear models based on district fixed effects as well as sampling weights. The results from the 8,568 households surveyed showed that a household's satisfaction has a strong link with the duration of electricity supply in a day. An increase in the duration of electricity by an hour in a day or by one standard deviation increased satisfaction. Also, the quality of access to electricity in terms of hours of light in a day related to a household's satisfaction with their power supply situation. Thus, a one hour increase in electricity supply increased satisfaction by one standard deviation (6.5h). Meanwhile, the voltage rate raised satisfaction by 0.3 points on a 0–2 scale, which coincides with 40% of the standard deviation of satisfaction.

In general, satisfaction was much stronger on the duration of power supply than on the reliability or stability rate of electricity voltage. Although reliability was positively related to satisfaction, the relationship was weaker. The correlation of increased duration of electricity on satisfaction was the major difference between electrified and non-electrified households. Therefore, this study concluded that the utility derived from the increased duration of light in a day was the same as connecting non-electrified households.

3. Materials and Methods

3.1 Study area

The study area is Nigeria which lies between latitudes 4º 12′ 40.37″ N to 13º51′ 36.50 ″ N of the equator and longitudes 2º 45′ 47.735″ E to 14º42′ 55.123″ E of the Greenwich meridian. The country is located at the extreme inner corner of the Gulf of Guinea on the west coast of Africa. It occupies an area of 923,768 sq. km (356,669 sq mi), extending 1,127 km (700 mi) East to West and 1,046 km (650 mi) North to South. The country has 36 states and a projected population of 214,312,387, as at the end of 2019 (National Population Commission [NPC], 2006). The household sector is characterized by many sources of electricity. The most commonly used ones include electricity, generator, rechargeable lanterns, and torch lights/batteries (NBS, 2019).

3.2 Sources of data

A secondary data set was used for the study, obtained from the database of the National Bureau of Statistics (NBS) on the General Household Survey (GHS) Panel: Wave 4/2018-2019. The data set was extracted based on the households that are connected to the national electricity grid supplied by the Power Holding Company of Nigeria (PHCN). The data set showed that out of 4611 households in the survey, a total of 2,367 had electricity working in their dwelling while 2,254 did not.

3.3 Variables measurement

Table 1. Variables Measurement

Variables	Measurement
Consumer Satisfaction	This is the dependent variable for this study. It was measured in a dummy form given as =1 for households who did not report any problem in relation to the various factors given below.
Health and Safety	This was measured by the number of weeks it took for the staff of PHCN to address the technical issue (whether swiftly or not).
Duration	This was measured by the number of hours in a day during which electricity was available
Reliability	The reliability indicator variable was measured by the number of hours of blackout in a day.
Quality	This was determined by the households whose appliances were damaged by PHCN
Affordability	This was measured in naira paid to offset the electricity bill monthly.

Independent Variables Adopted based on GTF (World Bank, 2017).

3.4 Model specification and method of estimation

3.4.1 *Descriptive Statistics*

Descriptive statistics, which is a method of describing the characteristics of a data set in a way that would be well understood was used to present the various factors affecting households' satisfaction with electricity supply in Nigeria. Hence, frequencies and standard deviation were utilized.

3.4.2 *Logit Model*

The logistic regression procedure was used to estimate the model of satisfaction with services of electricity supply in Nigeria. It is the appropriate technique here because the dependent variable is dichotomous. The model is given as:

$$\ln[p/(1-p)] = \alpha + \Sigma(\beta_k)(X_k)$$

where:

p = probability that a household is satisfied with the services of electricity supply

$p/(1-p)$ = odds that a household is dissatisfied

α = constant term

β_k = parameters of the model

Coefficients in a logit model give the change in the log-odds of being dissatisfied for a unit change in the explanatory variables.

4. Results and Discussion

4.1 Descriptive statistics

Descriptive statistics were used to present the first objective, which is the various factors affecting households' satisfaction with electricity supply in Nigeria. Hence, frequencies, mean, and standard deviation were used. The results are presented in table 2.

Table 2. Factors Associated with Electricity Supply In Nigeria

Variable	Frequency	Mean	Standard Dev
Access to Electricity			
Yes	51	50	2
No	49		
Do you have a Prepaid Meter?			
Yes	25	3	1
No	75		
Reliability			
1 – 3	32	3	7
4 – 6	24		

Variable	Frequency	Mean	Standard Dev
7 – 12	24		
13 – 24	11		
>24	2		
Duration			
1 – 3	26	4	5
4 – 6	37		
7 – 12	30		
13 – 24	15		
>24	0		
Quality			
Appliances damaged	12	1	0
Appliance not damaged	88		
Health and Safety			
1	26	4	2
2	17		
3	12		
4	14		
>4	13		
Affordability			
≤ ₦1500	36	1532	1198
₦1501 – ₦4500	43		
₦4501 – ₦10000	11		
>₦10000	10		
Households' Satisfaction			
Satisfaction	25	3	1
Dissatisfied	75		

Source: GHS (NBS) 2019.

Table 2 presents the various factors associated with electricity supply in Nigeria which either result in households' satisfaction or dissatisfaction. Out of the total households interviewed in Nigeria, about 50% had access to electricity with a mean of 50 and a low standard deviation, indicating that the data point is close to the mean, thus has low variability. Also, only 25% of these households had a prepaid meter, implying that about 75% were being charged monthly rather than on the basis of the duration of electricity supplied (NBS, 2019). Reliability and duration had mean values of 3 and 4, and high standard

deviations of 7 and 5 respectively. This could be attributed to the fact that the reliability and duration of power supply differ across the country with some having more or less in a day, hence the high variability. This is in line with the result obtained by Akaranga (2014).

With regard to the quality of electricity, the frequency of those who encountered a problem with voltage instability was very low compared to those that did not. Moreover, health and safety, relating to how many weeks it takes for the PHCN staff to show up for technical and maintenance issues, gave a mean value of 4. It shows that it takes them a week or less to attend to technical issues. This agrees with the finding of Akaranga (2014). On affordability, the mean monthly expenditure was ₦1532. Finally, the dependent variable shows that the majority of households (75%) were not satisfied with the services of PHCN. This agrees with the findings of Anyomi (2014) and Wakuru (2012).

4.2 Logistic regression analysis

Logistic regression analysis was used to determine the factors affecting households' satisfaction with electricity supply in Nigeria. The result is presented in table 3.

Table 3. Factors Affecting Households' Satisfaction with Electricity Supply

Variable	Coefficient	Standard error	T value	p>[t]
Constant	12.2941	0.9006	13.65	0.000*
Duration	0.1048	0.104	10.05	0.000*
Reliability	-0.3686	0.0272	-19.69	0.000*
Quality	0.3869	0.1789	2.16	0.030*
Affordability	-0.1278	0.0355	-3.6	0.000*
Health and Safety	-0.6055	0.205	-2.94	0.000*
Log Likelihood	-491.4			
Chi2 value	5988.9			
Prob Chi2	0.000*			

Source: Computed by the author, using data from GHS (NBS) 2019.

Table 3 presents the various factors affecting household satisfaction with electricity supply in Nigeria. The log likelihood value is greater than 1 and is

significant at 1%. With regard to the variable representing duration, it was found to be positive and significant at 1%. This implies that the higher the number of hours of electricity in a day, the more the satisfaction of the household. This agrees with the result of Aklin et al. (2016). Moreover, the magnitude of the coefficient of the t-value was the second highest (10.05), indicating that the more the duration of light in a day, the more the satisfaction. The coefficient of reliability on the other hand was found to be negative and significant at 1%. This shows that an hour's increase in power outage would decrease satisfaction by 19.69%. Thus, when the magnitude of the size of these t-values of duration and reliability are compared, *ceteris paribus* households would be more dissatisfied due to the reliability issue than they would be satisfied due to the duration of light. This is in line with the findings of Wakuru (2012).

The quality of electricity appears to have a positive coefficient estimate and is significant at the 1% level. This shows that the higher the level of voltage stability the more the satisfaction of the household. With regard to affordability, table 3 shows it is negative but significant at 1%. This indicates that the amount paid in respect of the electricity supply tends to exert a negative effect on household satisfaction. Similarly, the coefficient of health and safety was also found to be negative but significant at 1% indicating that the longer it takes PHCN staff to respond to maintenance issues, the lower the satisfaction of the households. This agrees with the findings of Anyomi (2014). Thus when the magnitude of the t-values for the hours of reliability, affordability, and health and safety are compared, the household's satisfaction is affected more by reliability, than affordability, and finally health and safety.

5. Conclusion

This study analysed the factors affecting households' satisfaction with electricity supply in Nigeria. The results reveal that half of the households in Nigeria have access to electricity. On reliability and duration, the results showed some variability due to the variation in electricity supply among the different areas in Nigeria. The quality of electricity was, however, found to have affected fewer households. Moreover, it takes the PHCN staff a week or less to show up for health and safety issues while the mean monthly expenditure on the PHCN bill was ₦1532. Finally, the majority of households are not satisfied with the services of PHCN.

In general, the satisfaction of the households was affected more by reliability than duration, although they were satisfied with the duration too even if the quality was poor. Also, even though the delay in response to health and safety issues affected their satisfaction, affordability affected it more.

6. Recommendations

This study proffers the following recommendations:

- The PHCN should improve the reliability of electricity supply by increasing the duration of electricity supply.
- Also, electricity consumption should be made affordable to households. The charges should be re-evaluated especially for those without a prepaid meter. Charges should be on a duration basis.
- Moreover, quality and health and safety issues should be improved and responded to more swiftly. A system should be created whereby customers are switched automatically to another power line when the one serving them fails. Also, there should be re-conduction of high voltage lines to a higher current-carrying capacity. Also most overhead lines should be converted to underground cables; this will reduce power failure and losses. The PHCN staff should also step up their game in the field based on monitoring and evaluation to reduce or totally prevent such situations.

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