INVESTIGATING ELECTRICITY CONSUMPTION IN OGUN STATE, NIGERIA

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Abstract: This study examined electricity consumption in a Nigeria township with a view of understanding the challenges faced by electricity consumers and to proffer practicable suggestions for sustainable electricity supply. Major findings emanating from the study show that 26.7% of respondents acknowledged the electricity supply through the electricity service provider (ESP). Again, 71% of respondents relied on electricity through the alternative's sources complementing ESP services. Furthermore, 75% of respondents confirmed a temporal supply of 5 hours daily representing 20% daily electricity supply. In another dimension, in terms of billing, 62.4% received estimated electricity bills as many homes are without electricity meters. Finally, this study revealed some planning and policy implications and provided recommendations through which electricity consumption in the state could be improved upon.

Keywords: electricity, consumption, planning, policy, Ogun State

1. INTRODUCTION

Importance of energy (electricity) provision and consumption to any nation, especially in the developing economies, cannot be overemphasized. It remains one of the major stimulants for economic development and national transformation. Energy is an indicator for measuring economic progress by many nations [1, 2]. Easy access to energy generation, transmission and distribution have been associated with urbanization, good health and industrialization. This is because the availability of energy leads to multiple changes and dynamics present in the society. Energy consumption has made life and livelihood conducive for man be it in transportation needs, industrialization, infrastructures development and consumption of the domestic appliance. It is also important to note that easy access to energy consumption has reduced unemployment and crime [1].

Despite the importance of energy (electricity) for a nation, most developing countries Nigeria inclusive are confronted with multiple challenges of inadequate provision of energy services to their communities, thus hampering improvement in the living standard of its people [1]. The Nigerian power sector is being slowed down by factors such as value chain losses, limited transmission coverage and supply disruptions as well as theft and corruptions (particularly in distribution) [3]. Considering these challenges, the attainment of economic growth by

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Nigeria become a tall order. Though there are on-going power generation projects with the projected installed capacity of 32.8 GW, which is believed that even with the existing efficiency rates and losses across the value chain, the consumption per capita for Nigeria is projected to reach 433kWh in 2025 [2]. This projection is regarded low when compared with countries like Ukraine, Uzbekistan, Egypt, Vietnam, Indonesia, Morocco, Philippines and Sri Lanka. Also, it is noteworthy that Nigeria's population triple that of South Africa, but the country has less than a third of the installed power generated capacity of South Africa. At that time, Nigeria has a per capita power consumption of 151 kWh per year, which is one of the lowest in Africa [3]. This shortfall corroborates [4] viewpoint that "energy poverty is entrenched in Nigeria…" Not only that Nigeria currently grapples with energy poverty, but there is also the case of huge income loss to the nation due to power outages, with the estimates put at 126 billion naira (US$ 984.38 million) annually [2]. And in order to compensate for the electricity shortfall, there have been consistent usage of power generating set by households and businesses leading to carbon emission causing health hazards [2].

Nigeria is essentially an export-import dependent economy. Its economy is predominantly that of oil and gas and agro-allied, suggesting that the country should guarantee the availability of seamless energy (electricity) to power these activities. The agro-allied industries and primary agricultural activities especially the peasant farmers are most affected with weak electricity availability across the economic space of the country. The agro-based products get rot because of storage and preservation dilemma. Hence, with the regular supply and availability of electricity to power storage facilities, the level of unemployment and underemployment would have reduced drastically through self-employment.

Energy distribution and consumption is a global phenomenon that requires adequate and functional policy responses in order to ensure that all the social, economic, political, industrial and manufacturing needs of these stakeholders are met. In Nigeria, energy distribution and consumption over the years have been an issue of great worries and concerns to the extent that economic development has been affected partly by the epileptic distribution of electricity. Studies on energy consumption have focused on the causal relationship between energy consumption and economic growth [5, 6]. It is noteworthy that these studies have also arrived at conflicting outcomes which have been linked to various factors. These variations have therefore been attributed to the use of diverse data set, alternative econometrics methodologies, differing countries characteristics [1, 5].

In view of the foregoing, this study aims at investigating electricity consumption in Ajegunle/Abalabi Township in Ogun State, Nigeria with a view to addressing the problem encountered by the electricity consumers. The specific objectives are to examine the socioeconomic characteristics of residents as well as study the determinants of energy consumption within the study area.

2. MATERIAL AND METHODS

2.1. Study Area

The research study area is Ajegunle/Abalabi township of Ewekoro local government area (LGA) in Ogun State, Nigeria (Figures 1 and 2).

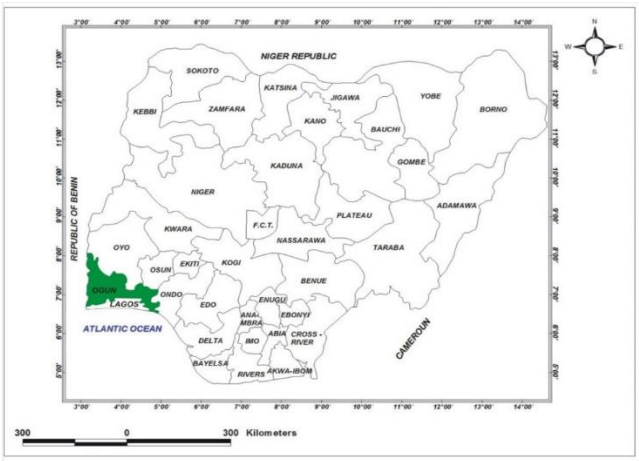


Fig. 1. Ogun State within Nigeria.

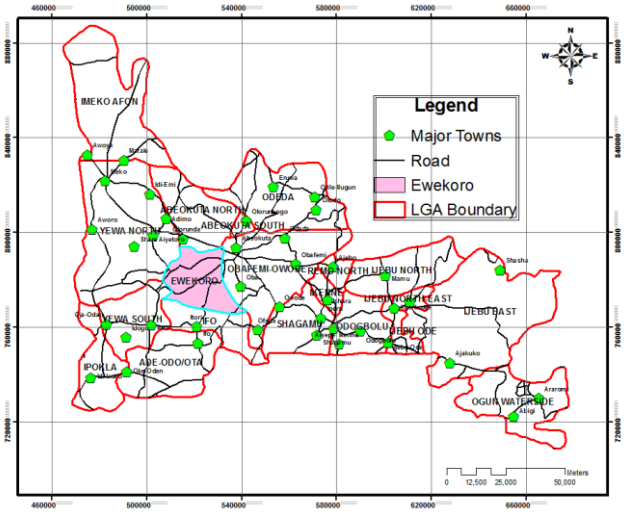


Fig. 2. Map of Ogun State showing Ewekoro Local Government Area [7].

The LGA has a geographic area of 594 square kilometers with an estimated population of over 100,000 in 2018. Ewekoro LGA is accessible by Lagos-Abeokuta Expressway that traverses the area in the north-south direction. Another important road in the LGA is the International Highway (Ilaro-Papalanto Road) to which the Ajegunle/Abalabi Road abut. The transportation network is defined by various categories of roads and terminals. Movements within the LGA are attained through private vehicles, cabs, commercial vehicles and motorcycles. Terminals within the LGA are sited along Lagos-Abeokuta Expressway.

Ajegunle/Abalabi township is located in the western part Ewekoro LGA (Figure 3) and constitutes two of the major towns and villages within the LGA. The township is surrounded by communities such as Abule Odo, Asa Obinti, Oteyi, Ibogun Giwa, Agodo, Iganmu, Ibogun Sowunmi, Sojuolu, Ogbaga, Oyeyika, Idiaga, Yobo and Olorunda. The study area is 10 km to Ilaro, 8 km to Ewekoro, 15 km to Ifo and 6 km to Ibogun where the College of Engineering and Environmental Studies of the Olabisi Onabanjo University is situated. It is noteworthy that Ajegunle/Abalabi Township is a twin-town connected, interwoven and linked together socially, economically and culturally. As a result, the communities commonly share social infrastructure, amenities and services. The community is essentially an agro-allied dominant economy. The demographic composition of the town suggests that most residents are self-employed, hence would require electricity to prop up their trade and businesses. The community relies on Ibadan Electricity Distribution Company (IBEDC) for their electricity consumption.

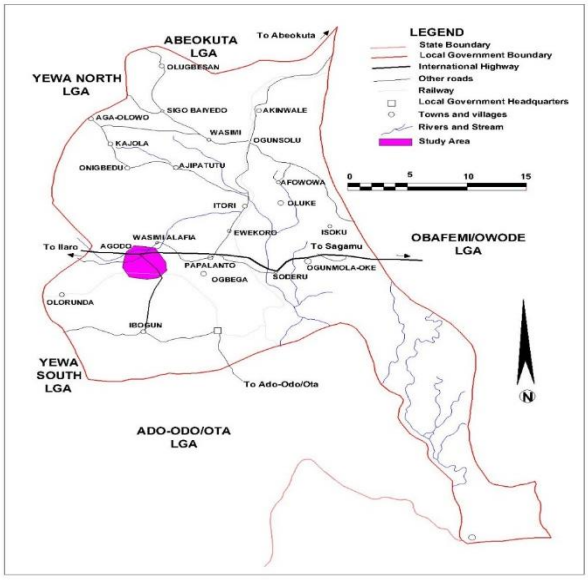


Fig. 3. Map of Ajegunle/Abalabi township.

This study on electricity consumption in Ogun State is a survey that is funded by IBEDC. IBEDC is an electricity service provider in the community (study area) and it is believed there is an urgent need to introduce or adopt scientific and analytic methodology as a service provider towards enjoying a better focus of understanding of electricity consumption from their clients, hence the data used for this report are partly used in this study. IBEDC is a private sector electricity service provider. It emerged as a result of the privatization and commercialization policy of the government to disengage from operating and providing electricity. Government has now focused essentially on regulatory of the energy sector.

2.2. Study Methodology

This study relied on data from both primary and secondary sources. The primary sources consist of the field survey approach and observation. For the field survey, a questionnaire was administered to elicit information from the residents of the study area. The secondary data sources comprising journal articles, private organization publication and other informal sources were utilized to complement primary data.

The questionnaire utilized for this study addressed issues pertaining to residents' socioeconomic characteristics, sources of energy supply, and energy consumption. For ease of questionnaire administration, the researchers engaged 12 survey assistants who were briefed about the study aim and objectives. The briefing allows for clarification on any aspect of the questionnaire before survey assistants were deployed for the actual field survey. This approach also allows for the retrieval of all questionnaires administered as survey assistants guided respondents in the conduct of the questionnaire. A total number of 120 copies of questionnaire were administered and retrieved, thus implying 100% retrieval rate.

Systematic random sampling technique was used in the selection of samples for administration. The sampling technique was adopted for the effective coverage of the study area. Furthermore, the choice of using this sampling technique is to allow for easy administration of the research instrument. Data collected were analysed using descriptive statistical methods which include frequency distribution analysis, and percentages. The data analytical tool employed was the Statistical Package for Social Sciences (SPSS) while the graphs and charts were generated with the Microsoft Word, Office 2016.

3. RESULTS AND DISCUSSIONS

3.1. Socioeconomic characteristics of respondents

Of the 120 respondents, 48.3% are male while 51.7% are female, thus indicating no bias towards any particular gender. The age distribution of respondents revealed the majority (87.5%) belong to the working age group which is an indicator of the potential for economic growth and development if well harnessed. Also, results show that about 86% of the respondents are literate having obtained one form of education or another. It is noteworthy that 90% are gainfully employed though they are involved in trading, farming and artisanship. Respondents' monthly income showed that the majority are low-income earners with about half of them earning below the ₦18,000 ($50), the national monthly minimum wage in Nigeria (Table 1).

Table 1. Socioeconomic characteristics of respondents.

Gender	**Frequency**	**Percent**
Male	58	48.3
Female	62	51.7
Total	*120*	*100.0*
Age		
Below 20 years	4	3.3
21-30 years	34	28.3
31-40 years	41	34.2
41-50 years	30	25.0
Above 50 years	11	9.2
Total	*120*	*100.0*
Level of Education		
Informal	14	11.7
Primary	31	25.8
Secondary	62	51.7

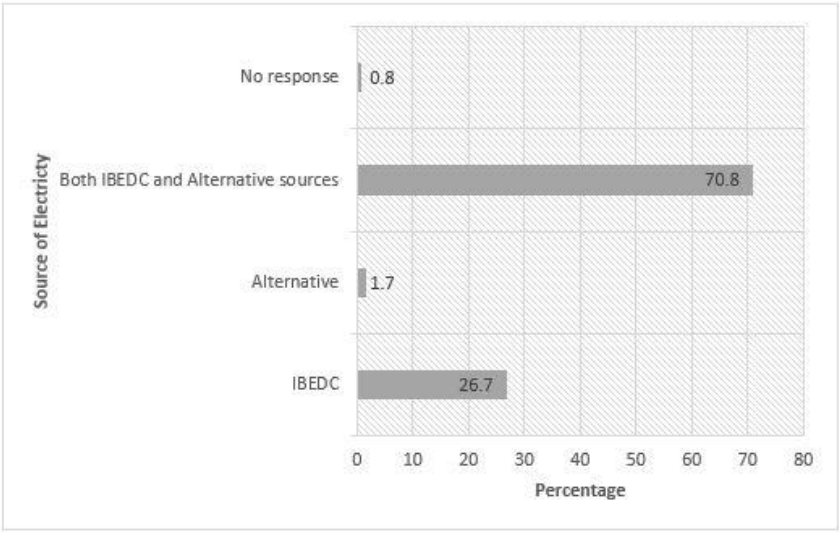
Tertiary	12	10.0
No education	1	0.8
Total	*120*	*100.0*
Occupation		
Farmer	24	20.0
Artisan	19	15.8
Trader	52	43.3
Retired	1	0.8
Unemployed	3	2.5
Student	6	5.0
Professionals	14	11.7
No response	1	0.8
Total	*120*	*100.0*
Monthly Income		
Below 18,000	58	48.3
18,001-30,000	19	15.8
30,001-60,000	15	12.5
60,001-120,000	8	6.7
Above 120,000	2	1.7
No Response	18	15.0
Total	*120*	*100*

Authors' Field Survey, 2018

3.2 Electricity consumption

3.2.1 Sources of electricity and available alternatives

Results from Figure 4 revealed that respondents depend on electricity supply by the Ibadan Electricity Distribution Company (IBEDC) and other alternative sources. While only 26.7% of the respondents relied solely on IBEDC for electricity supply, about 71% combine supplies from the IBEDC and alternatives to meet their electricity demands.



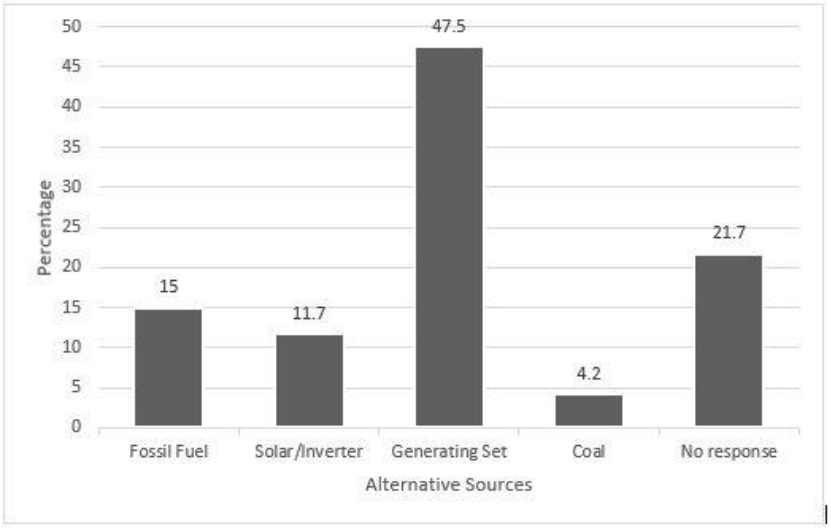
Authors' Field Survey, 2018

Fig. 4. Source of electricity.

Further probe into the alternatives utilized by respondents (Figure 5) revealed that about 48% of the respondents used power-generating sets whereas 1.7% used solar/inverter. The remaining respondents making up about 19% used fossil fuel and coal. This result is in contrast to 2008 Report of the eWaste Country Assessment Nigeria cited in [8] where it was stated that in Ogun State, 69.8% of households relied on PHCN (electricity service provider)

only for electricity supply, 0.8% received supply from power- generating set and 8.5% from PHCN and power-generating set. While none obtained supply from solar, 20.4% did not have access to electricity.

From the results, energy (electricity) importance in homes, commercial and industrial developments became evident as significant proportion sourced electricity from IBEDC. It can be implied that low electricity supply made residents resort to alternatives such as power-generating set, solar/inverter, fossil fuel and coal although the power-generating set is predominant. Of the alternatives, the solar/inverter is the only renewable energy source considered as environmentally friendly. The consumption of petrol or diesel, fossil fuel and coal as alternatives poses threats to both public health and the environment.



Authors' Field Survey, 2018

Fig. 5. Alternative source of electricity.

1.2.2. Temporal/Duration of electricity supply by IBEDC and respondents' access

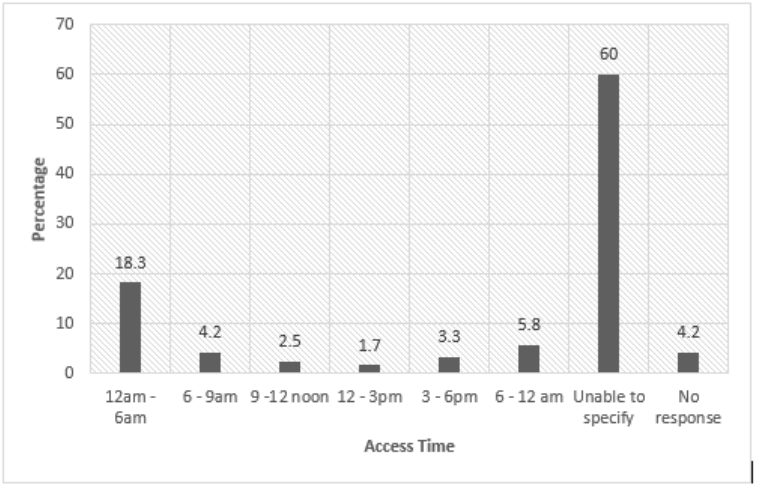
The majority (75%) of the respondents confirmed they received supply between 1-5 hours while 13.3% said supply was between 6-10 hours. Another 7.5% of the respondents opined 11-16 hours of an electricity supply whereas marginal proportion (1.7%) stated above 17 hours (Table 2). The difficulty in tracking the duration of electricity supply to the community indicate the epileptic nature of the supply.

Moreover, data collected regarding the respondents' daily access time to electricity revealed that 60% of the respondents could not specify. Though 18.3% stated that access time was between 12 midnight–6am but marginal proportions were reported for access confirmed 6am and 12 midnight (Figure 6), thus suggesting the epileptic nature of electricity supply to the community. The result implies that there are variations in access time, which could also be influenced by respondents' activity schedules considering that majority belong to the working age group.

Table 2. Temporal/Duration of electricity supply by IBEDC.

	Frequency	**Percent**
1-5 hours	90	75.0
6-10 hours	16	13.3
11-16hours	9	7.5
Above 17 hours	2	1.7
No response	3	2.5
Total	**120**	**100.0**

Authors' Field Survey, 2018

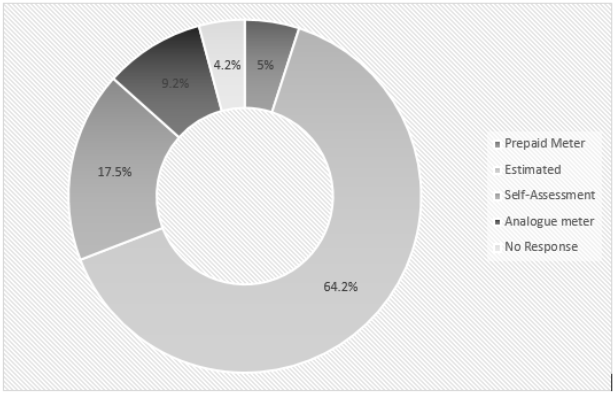


Authors' Field Survey, 2018

Fig. 6. Respondents' access time to electricity

3.2.3 Payment mode for electricity consumption

From Figure 7, the electricity consumption mode of payment adopted in the study area is predominantly estimated approach as confirmed by 64.2% of the respondents. Next to the estimated approach is the self-assessment by 17.5% of respondents. Equal proportion (9.2%) of respondents paid electricity bills generated through the analogue meter and prepaid meter on electricity consumed respectively. 4.2% of the respondents did not specify payment mode and may include the section of residents that avoid payment of electricity bills.



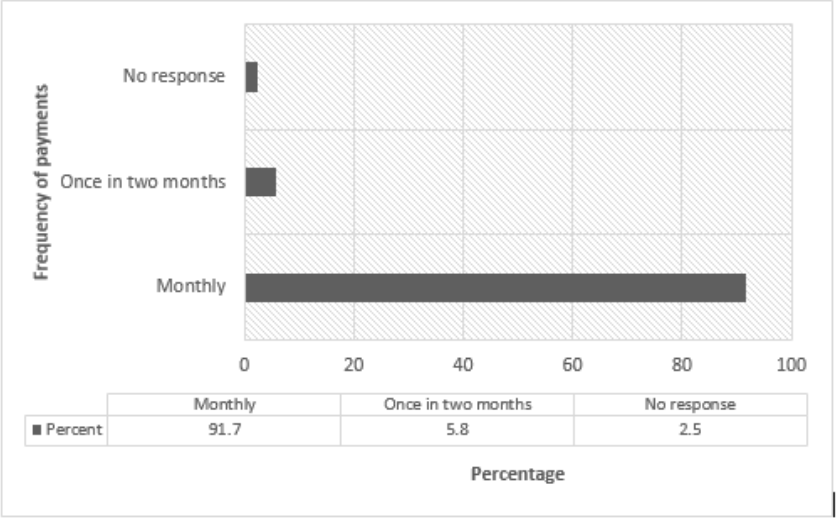
Authors' Field Survey, 2018

Fig. 7. Payment Mode for electricity consumption.

More importantly, the results indicate that the majority are without electric meter, which suggests energy consumption cannot be measured. The estimated approach deployed by the IBEDC to charge an electricity consumer is not the best method to ascertain consumption since there will always be the problem of overcharging and undercharging. And according to some residents, the estimated electricity bills are not a true reflection of households' electricity consumption. Invariably, this trigger consumers' resistance to the payment of electricity bills.

3.2.4 Frequency of payments of electricity bills

Regarding the frequency of payment by respondents, results indicated that the majority (92%) of the electricity consumers pay their electricity bills monthly while about 6% pay once-in-two-months (Figure 8). The positive response recorded can be linked to the collection strategy adopted by the IBEDC. The trend will continue except prepaid meters are installed in the community as already witnessed in some communities in Ogun State and across Nigeria.



Authors' Field Survey, 2018

Fig. 8. Frequency of payments of electricity bills.

3.2.5 Power generating set usage time

Data were collected concerning the respondents' daily usage time of power-generating set, as electricity supply source, revealed that equal proportion (17.5%) of respondents used the set between 1-2 hours and 3-4 hours respectively, 5.8% utilized for 5-11 hours and equal proportion (0.1%) used the set for 12-15 hours and above 15 years respectively (Table 3). The result reflects the financial capacity of the respondents. Despite the importance of electricity in homes, only 7.4% could afford to supply power beyond four hours daily.

Table 3. Power generating set and usage time.

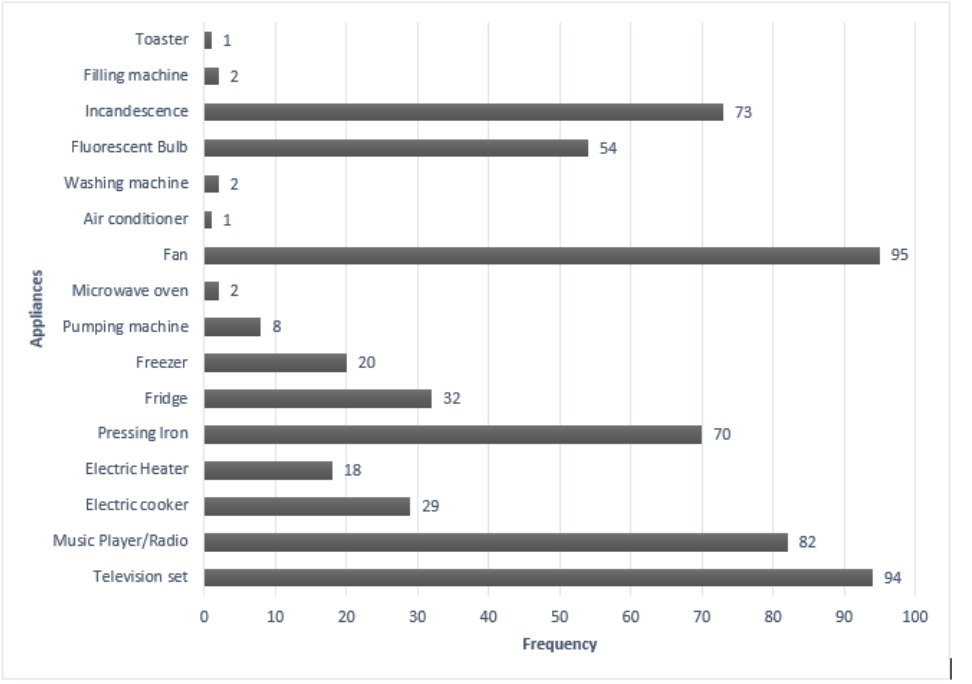
Usage Time	**Frequency**	**Percent**
1-2 hours	21	17.5
3-4 hours	21	17.5
5-11hours	7	5.8
12-15 hours	1	0.8
Above 15 hours	1	0.8
No response	69	57.5
Total	**120**	**100.0**

Authors' Field Survey, 2018

3.2.6 Consumer loads

The electrical appliances consumed by households is shown in Figure 9. It is evident that the community is characterized by a low energy consumption, considering the type of appliances used.

The loads' consumption found in typical homes in the study area includes television set, music player/radio, electric cooker, electric heater, pressing iron, fridge, Freezer, pumping machine, microwave oven, fan, air conditioner, washing machine, fluorescent bulb, incandescence bulbs, filling machine and toaster. More modern homes might have a computer, washer and dryer, satellite dish, microwave, and additional lights. It is difficult to characterize the monthly electric consumption of the residential sector because billing information for individual consumers is not readily available.



Authors' Field Survey, 2018

Fig. 9. Electrical appliances used by respondents.

4. PLANNING AND POLICY IMPLICATIONS

Based on the findings from the study, planning and policy implications are drawn are as follows:
- Based on observed socioeconomic and demographic characteristics of the settlements, it is observed electricity consumption is not essentially on the high side given hybridization survey provided. Hence, the effort will remain to establish cordial community relation to ensure the overall protection and safety of equipment provided.
- This study reveals that the distribution and installation of electrical infrastructures do not reflect serious physical planning presence. And by implication, electricity infrastructure such as transformers, poles, and conductors (wires) are not guided by the planning concept or principles.
- The electricity service provider needs to develop electricity master plan for the distribution, siting and expansion of electricity infrastructure in the study area and by extension to the nation.
- Safety and protection of electricity infrastructure and amenities should be prioritized. It is also to form part of the community stakeholder's discourse from time to time.
- It is essential for the electricity service provider to relate with the Ministry of Physical Planning and Urban Development for the establishment of appropriate setbacks for the infrastructures. There would also be the need to relate with the local government and community development association in order to ensure adequate mobilization of revenue recovery process for services rendered through the service provider.

5. CONCLUSIONS

This study investigated electricity consumption in Ajegunle/Abalabi township in Ogun State, Nigeria with a view of addressing issues of electricity consumption. Findings indicated that 26.7% of respondents received supply from the electricity service provider whereas about 71% used supplies from the electricity service provider and alternatives. The alternatives utilized by residents include power-generating set, solar/inverter, fossil fuel and coal. Of these alternatives, solar/inverter is the only renewable energy source and is used by 1.7% of the respondents. The use of power-generating set by 48% of the respondents combined with 19% that utilized fossil fuel and coal portend danger for public health and the environment. Also, the epileptic nature of the electricity supply was confirmed as 75% of respondents received supply for a maximum of 5 hours daily but only 7.4% could privately supply electricity via power-generating set beyond 4 hours daily. Again, 62.4% received estimated electricity bills

as most residents are without electricity meters, thus overcharging and undercharging problems become inevitable. It is against this backdrop that the following recommendations are made.

Infrastructural support for electricity distribution to the satisfaction of consumers should be given priority. Therefore, IBEDC should see to deploying state-of-the-art infrastructure that would serve the consumers and give value for the money. Without infrastructure, energy generated becomes unusable and the initial objective of the electric generation becomes defeated.

There is a need to upgrade infrastructure within the context of socio-economic expansion in the communities to avoid overload. There must be a strategic response to population dynamics. As the demand for electricity increases, there must be a corresponding increase in energy supply to communities in order to meet their needs. This is important so that available infrastructures are not overstretched, and subsequently breakdown, before attaining their useful life as designed by the manufacturers. The implication of this is there is a need to keep tab with the appropriate government agencies like the National Population Commission (NPC), National Bureau of Statistics and States Statistics Bureau.

The IBEDC strategy of deploying personnel for collection of electricity bills should be sustained as it seems effective as revealed by this study.

The installation of prepaid meter in the households and other land use developments within the community will ensure that consumers' perceptions of overcharging by the IBEDC is taken care of.

The electricity service provider should collaborate with town planning authorities by way of obtaining land use plans of the settlements from time to time. This would assist in understanding the development patterns and monitoring of development in the settlements. Consequently, the electricity distributor would find it easy to site electricity infrastructure, and more importantly, carry out development in accordance with the planning regulations. Another merit of this collaboration is that the electricity service provider would find cost recovery easier if the city layout is properly executed.

ACKNOWLEDGEMENT

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