ELECTRICITY END USE CHARACTERISTICS OF PUBLIC UNIVERSITIES IN SOUTHWESTERN NIGERIA

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ABSTRACT: *The paper investigated the electricity end use characteristics of public universities in Southwestern Nigeria; examined the patterns of electricity use in public universities and determined the proportion of electricity consumption by various stakeholders. We adopted a quantitative survey and questionnaire as instrument for gathering relevant data from electricity end users in the study area. In addition, energy monitor was employed to determine the actual consumption of each end user. The data obtained were used to develop regression model for predicting electricity consumption of public universities in the study area. The percentage contribution of the four stakeholders' groups investigated, namely Staff offices, Business units, staff and students' halls of Residences were 12.45% – 42.18%, 171% – 6.77%, 3.32% – 12.25% and 43.50% – 82.52%, respectively. Forty-four key electrical appliances were identified in the study area. Analysis of the data retrieved showed that electric cookers, A/C, electric jugs, stabilizers, pressing iron, photocopiers, electric kettles and printers consumed 14.14%, 14.07%, 8.53%, 7.87%, 6.48%, 5.12%, 4.51% and 4.17% in that order respectively. It was found that the regression model developed could predict the electricity consumption of public universities in the study area for every unit increase in the predictor variables.*

KEYWORDS: Electricity, End use characteristics, Electrical equipment, Public universities, Southwestern Nigeria

INTRODUCTION

Throughout the world electricity is the most widely used and desirable form of energy (Oyedepo, 2012a). It is the bedrock, indispensable driving force and essential ingredient as well as a basic requirement for socio-economic growth and development (Oyedepo, 2012b; Onakoya *et al*., 2014; Oyedepo *et al*., 2015). There is hardly any aspect of modern life that does not have the imprint of electricity input. Be it entertainment, recreation, agriculture, commerce, industry, transport, education, communication, health, architecture and many others (Unachukwu *et al*., 2015). However, high electricity consumption is a key issue facing all sectors of any economy worldwide and Nigeria is not exempted from the issue of high electricity demand (Ubani, 2013).

On the other hand, even though Nigeria is endowed with massive reserves of hydro energy, petroleum and gas (Nwachukwu *et al*., 2014), most of the country's citizens do not have access to uninterrupted supplies of electricity (Ubani, 2013). Electricity outage is one of the main challenges confronting the residential, commercial and industrial sectors of the Nigeria's economy and all attempts at addressing this problem have not yielded the desired results (Nwachukwu *et al*., 2014). A fundamental reason offered is the low generating capacity of the Nigeria power sector relative to installed capacity (Ubani, 2013). However, Nwachukwu *et al*. (2014) and Abimbola *et al*., (2015) pointed out that the persistent electricity problems in

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Nigeria are not only caused by low generating capacity, but attributable mostly to the inability of energy planners to accurately forecast the determinants of the dynamics of electricity consumption in Nigeria. They noted that, without a doubt, the challenges of electricity affordability, security and the sustenance of available electricity resources in Nigeria require more accurate estimates of key electricity demand parameters. In addition, knowing how much electricity is used and data on electricity consumption characteristics in various sectors of Nigeria economy are the way forward (Oyedepo, 2012a, 2012b, 2014; Unachukwu *et al*., 2015). Often, unduly assumptions have been made in the estimation of electricity demand and consumption (Abimbola *et al*., 2015). In most cases, the estimated models are likely to have produced spurious parameters. Obviously, policies based on such parameters are more likely to result in wrong policy actions.

In modelling the electricity demand function in Nigeria, often and for various reasons, strong emphasis has been placed on residential, commercial and industrial sectors of Nigeria economy (Ekpo *et al*., 2011; Oyedepo, 2012a, 2012b, 2014; Nwachukwu *et al*., 2014; Unachukwu *et al*., 2015), while quite a little is known about the fundamentals of electricity demand in university subsector. This is due to the belief system of energy analysts that the demand for electricity in Nigeria is squarely and mainly for industrial, commercial and residential (Ekpo *et al*., 2011). The other reason may be that electricity usage in university subsector remains invisible to them, and as such they cannot easily identify how much electricity this subsector ends up consuming in the country. This neglect has strong policy implications for energy analysis in the country as studies and reports have shown.

In recent years, for University Occupier Buildings (UOB), it was found that generally the dynamic of electricity demand and consumption in university subsector is known to exhibit increasing growth and compare favourably with other sectors of Nigeria economy. The subsector is known to depend heavily on electricity for virtually all activities and operations that include teaching and educational aids, lighting, air conditioning systems and operation laboratory equipment and machinery used for practical and demonstrations as well as all other support services (Adelaja *et al*., 2008; Unachukwu, 2010). Past studies and reports (Unachukwu, 2010; Olanipekun, 2012; Hawkins *et al*., 2012; Ohashi and Shimoda, 2014; Nigerian Electricity Regulation Commission, 2014; National Bureau of Statistics, 2015; Nigerian Data Portal, 2015; Oyedepo *et al*., 2015) indicated that universities consume copious amounts of electricity daily and their consumption is almost comparable to commercial sector electricity use. Figure 1 shows the trend of electricity consumption of the acclaimed three major users in Nigeria. By visual inspection, electricity consumption in industrial sector constituted the largest consumer of electricity, followed by residential sector and then commercial sector and street lighting until 1978 when residential sector took over. Since then the residential sector has dominated other sectors, while the industrial sector's demand has witnessed continuous downward trend**.** The commercial and street lighting sector maintained relatively stable electricity consumption between 1990 and 2009 and slightly above the industry.

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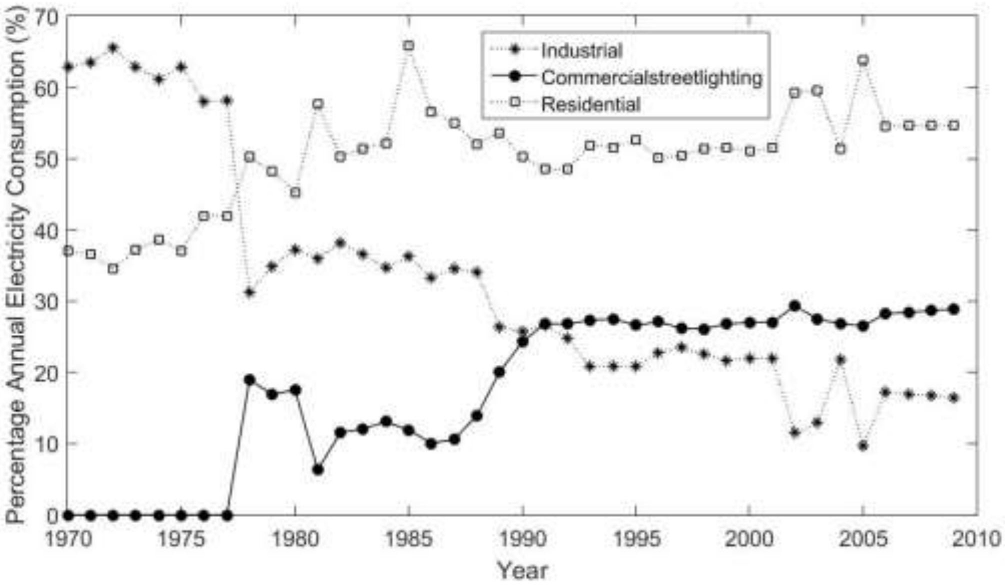

Figure 1. Percentage breakdown of electricity consumption among the three major sectors in Nigeria (1970–2009).

On the other hand, Figure 2 compared the trend of electricity consumption for a ten-year period for some universities in Nigeria (University of Nigeria, Nsukka – UNN and Covenant University, Ota – CU) with that of residential, commercial and industrial sectors. Although much explanation has been offered on the supply of electricity in the three sectors, the profiles of electricity consumption shown in Figure 2 indicates that university activities and operations heavily rely on electricity also. Based on data available, a comparison of the patterns of electricity demand in university subsector with that of the major electricity users in Nigeria reveals that the subsector is a major player in Nigeria energy mix and its electricity demand compared favourably with these three sectors of Nigeria economy.

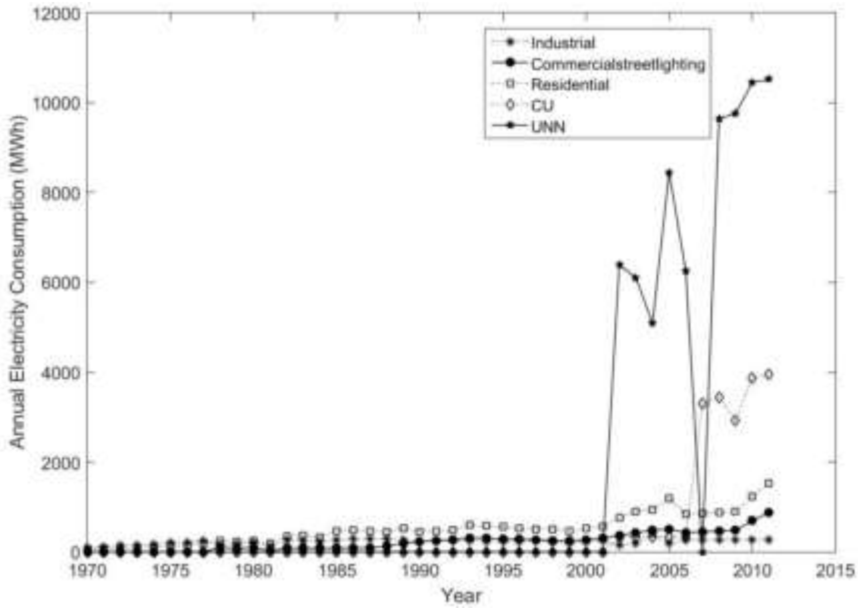

Figure 2. Trend of electricity consumption of residential, commercial, industrial and Universities in Nigeria

Given the present status of university subsector in Nigeria energy mix, clear insights into the dynamic nature of electricity demand and consumption in university subsector is essential for capacity addition, investment and effective optimal energy policies. Thus, any reforms embarked on by government to revamp electricity supply in the country, it becomes important to model the key drivers of electricity in university subsector to obtain more accurate empirical insights and data for electricity demand and supply projection and policy analysis**.** Given this situation, this study explored the key drivers of electricity utilisation in public universities in Southwest, Nigeria. The worth of this research is that energy-dependent sectors of the economy can be recognized for appropriate energy policy analysis and implementation. The outcome of this study will also be useful in enhancing policies towards eliminating electricity shortages in Nigeria.

LITERATURE REVIEW

A considerable literature exists on attempting to model and examine the determinants of electricity demand function within the context of developed and developing countries. Ward *et al*. (2008) carried out a sector review of UK higher education energy consumption. The findings indicated that energy consumption in the sector has been on the increase in the last 6 years up to 2006; rising by about 2.7% above the 2001 consumption levels. Gross internal area, staff and research student full-time equivalent were found to have highest correlation with energy consumption across the sector. Rosin *et al*. (2010) analysed household electricity consumption pattern. The study found that that loads with shiftable consumption (water heaters, dishwashers, and washing machines), almost shiftable loads (refrigerators, boiling kettles, coffee machines, floor heating, irons, and vacuum cleaners) and non-shiftable loads (TV sets, PCs with a modem, home cinema and music centers, cooking stoves, kitchen ventilation, bathroom lighting and ventilation) respectively accounted for 54%, 10%, 36% of the total consumption. Considering electricity consumption by customers' need or action, they found that eating, hygiene and free time/vacationing accounted for 31%, 56% and 13%, respectively. On the workday, two peak periods were detected: the morning and the evening. Both peak periods were in the high tariff period and consumption was affected mostly by water heater, cooking stove and lighting consumption. However, on the holiday, the two peak periods detected were the midday and the evening. These peak periods were in the low tariff period and consumption was mostly caused by water heater, cooking stove and lighting consumption. Sapri and Muhammad (2010) reviewed the state of knowledge of energy performance monitoring in the context of higher education institution in Malaysia. The study identified that developing a comprehensive building energy performance information system as one of the ways of promoting environmental sustainability in higher educational institutions. Ekpo *et al*. (2011) empirically investigated the dynamics of electricity demand and consumption in Nigeria between 1970 and 2008 using Bounds Testing Approach. The results showed that real GDP per capita, population and industrial output significantly drives electricity consumption in the long-run and short-run while electricity price is not a significant determinant. Hawkins *et al*. (2012) investigated determinants of energy use in UK higher education buildings using statistical and artificial neural network methods. For University Occupier Buildings (UOB) it was found that generally electricity use is high and heating fuel use is low relative to the CIBSE TM46 benchmarks for the University campus category. There was appreciable variation in energy use between different university-specific building activities. Activity was also shown to have a high ANN causal strength together with material, environment and glazing type. Emeakaroha *et al*. (2012)

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examined the challenges in improving energy efficiency among students in a University Campus. The results showed that immediate energy feedback from smart meters or display devices in addition to appointing an energy delegate in each hall to induce motivation among the students can provide savings of 5%–15%. Ahmad *et al*. (2012) presented the results of energy management program carried out at the Faculty of Electrical Engineering, Universiti Teknologi Malaysia. Various energy savings activities such as electricity tariff modification, energy management awareness campaign, energy consumption monitoring system and energy efficient lighting retrofits were initiated. The study showed the program has shown encouraging results with a reduction in the electricity consumption and provide further avenue for continuous energy saving programs. Lo (2013) analysed the energy conservation situation in China's higher education institutions (HEIs). A case study was conducted in Changchun, Jilin, where eight HEIs of various types were examined. The findings indicate that the HEIs have implemented comprehensive non-technical initiatives to conserve electricity, including electricity restrictions and extensions of winter breaks, as well as certain technical initiatives. Tang (2012) carried out an energy consumption study for a Malaysian University to obtain information on the number and specifications of electrical appliances, built-up area and ambient temperature in order to understand the relationship of these factors with energy consumption. He reported that air-conditioning; major electrical appliances (computers, printers, fax machines and photocopy machines); lighting and other electrical equipment (microwave ovens and fans) consumed 50%, 30%, 19% and 1% respectively. It was found also that the number and types of electrical appliances, population and activities in the campus impacted the energy consumption of Curtin Sarawak directly. However, the built-up area and ambient temperature showed no clear correlation with energy consumption. An investigation of the diurnal and seasonal energy consumption of the campus was also carried out. From the data, recommendations were made to improve the energy efficiency of the campus. Aishwarya *et al*. (2013) discussed the magnitude of voltage and current flowing through the campus of Easwari Engineering College, variation of peak load and calculation of maximum demand were also noted. An alert indicating the rise in power consumption was used as a monitoring system. Data obtained were grouped based on the service supplies - lighting, fans, air conditioning, computers, and miscellaneous. The results showed that fans, lighting, computers, Air conditioning, UPS and motors respectively consumed 6%, 7%, 19%, 23%, 12%, 14% while miscellaneous consumption was 19%. Manjunatha *et al*. (2013) conducted energy audit at BMS Institute of Technology, Yelahanka, Bangalore, to seek the opportunities to improve the energy efficiency of the campus. Beyond simply identifying the energy consumption pattern, the audit sought to identify the most energy efficient appliances. Moreover, some daily practices relating common appliances have been provided which may help reducing the energy consumption. The main focus of this paper is to achieve and maintain optimum energy throughout the organization so as to minimize energy costs and improve power quality. The study found that using day lighting as much as possible with proper ventilation and energy conservation slogans in the work area as can motivate them to conserve energy. Ohashi and Shimoda (2014) examined the energy consumption and proposed energy-saving strategy for Osaka University. The information obtained can be applied to other energy-consuming building systems. Son *et al.* (2015) reported the characteristics of energy consumption in a university dormitory. They observed that the energy used for heating and hot-water supply was the highest (64%). The weekday electricity consumption was higher, and this peak load occurred between 19:00 and 24:00. For men dormitories, the results showed that electricity consumed in 2-person rooms and 4-person rooms were similar, but for women, 4-person rooms used twice the electricity than the 2-person rooms. Sukarno *et al.* (2015) showed the share of electricity for different end uses in Padang. The study showed that cooking was the most energy consuming activity with

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a share of 53%, followed by cooling devices (17%), entertainment devices (10%), lighting (5%) and other devices (16%). Abimbola *et al.* (2015) investigated energy use pattern and emission discharge in Nigeria. Results obtained indicated strong relationship between energy use and emission with significantly different emission generation. The study concluded that about 38% and 25% reduction in global warming and acidification is achieved by a switch to prepaid meter for both income earners. A few studies on electricity in university have also been conducted (Adelaja *et al*., 2008; Unachukwu, 2010; Oyedepo *et al.,* 2015). However, in view of the complexity of the university setting, the existing works lay the foundation for further empirical investigations of electricity usage in Nigeria universities. Therefore, our current study examined the electricity end use characteristics of public university buildings in Southwestern Nigeria.

METHODOLOGY

A multi-stage sampling technique was used for the study. In the first stage, purposive sampling was used to select relatively old public universities with staff and students' halls of residences. In this regard, Obafemi Awolowo University (OAU); Federal University of Technology, Akure (FUTA); and University of Ibadan (UI) were selected. The second stage was the stratification of electricity users into users in academic office buildings, staff quarters, student residential hostels and business outfits. Student halls were categorized into two: undergraduate and postgraduate hostels. Student hostels were purposively selected to capture variation in gender and levels of study. In OAU, FUTA and UI, Moremi, Jadesola Akande and Awolowo halls, respectively were selected as representatives of female undergraduate hostels in the three universities, while Awolowo, Peter Adeniyi and Independence halls were selected as male undergraduate students in OAU, FUTA and UI, respectively. Murtala Muhammed Postgraduate hall in OAU, FUTA Postgraduate hall in FUTA and Abdusalam Abubakar Postgraduate hall in UI for both Male and Female students were also sampled. The population of students occupying these hostels earlier determined were 1228, 1200 and 1618 for Moremi, Jadesola Akande and Awolowo halls, respectively; 2,032, 1142 and 956 for Awolowo, Peter Adeniyi and Independence halls, respectively, while there were 1072, 400 and 700 in Murtala Muhammed, FUTA and Abdusalam Abubakar Postgraduate halls, respectively. One out of every twenty (5 %) students was selected in each hall. In all, 217, 137 and 164 students were sampled in OAU, FUTA and UI respectively. Preliminary investigation also showed that in OAU, FUTA and UI, there were 600, 50 and 1212 households, respectively in staff residential quarters while there were 552, 115 and 350 shops, respectively to constitute the sample frame for both staff housing units and business units. One out of every twenty (5 %) households and shops was selected. Using this method, 30, 3 and 61 households in OAU, FUTA and UI, respectively was sampled while 28, 6 and 18 business units in OAU, FUTA and UI, respectively was also sampled. For staff offices, accidental sampling was used across academic, administrative and other cadres of staff in the three universities. The sample size determined for staff in OAU, FUTA and UI were 139, 81 and 182, respectively. We adopted quantitative survey and questionnaire as instrument to gather relevant data from electricity end users in the study area. In addition, energy monitor was employed to determine the actual consumption of each electricity end user. The data obtained were used to develop regression model for predicting electricity consumption of public universities in the study area. The data were compiled and analyzed using SPSS 17.0.

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RESULTS AND DISCUSSIONS

General information of respondents

The general information about the respondents in the sampled universities is presented in Table 1. Slightly above half (50.7%) of respondents that participated in the survey were between 20-29 years, followed by age group 30-39 years (19.4%) while the least age group was 50 years and above (0.4%). Over half (59.2%) of the entire respondents were male and 40.8% were female. More than half (59.2%) were students, while members of academic staff were 18.9%. The non-academic staff members and business owners accounted for 16.5% and 5.5% respectively. Also, 60.6% of respondents had stayed on campus up to four years and one-quarter (25.7%) of respondents had stayed on campus between five and ten years; 7.1% had stayed on campus for 11-15 years while very few respondents have stayed on campus for 21 years and above. Meanwhile, respondents who resided in staff quarters were 12.8% while students who stayed in undergraduate hostels and post graduate hostels accounted for 32.0% and 22.8% respectively. The results clearly showed that the respondent's distributions in relation to gender, residence and status in the university were adequate and useful.

Table 1. **General information of respondents**

Respondents	Frequency	Percentage
University		
OAU	395	33.4
FUTA	392	33.2
UI	395	33.4
Age Group (Years)		
20-29	599	50.7
30-39	229	19.4
40-49	141	11.9
50+	5	0.4
Missing ages	208	17.6
Sex		
Male	700	59.2
Female	482	40.8
Status in University		
Academic staff	218	18.9
Non-academic staff	190	16.5
Student	683	59.2
Business owner	63	5.5

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Position Held		
Dean/Vice Dean	40	49.4
HOD	11	13.6
Director/Deputy Director	30	37.0
Academic Qualification		
HND	316	27.4
PGD	72	6.2
B.Sc./B.Tech.	55	4.8
M.Sc./M.Tech.	52	4.5
PhD	328	28.4
Others	332	28.7
Numbers of Years Stayed on Campus		
0-4 years	716	60.6
5-10 years	304	25.7
11-15 years	84	7.1
16-20 years	52	4.4
21-25 years	17	1.4
26 and Above	9	0.8
Location of Stay on Campus		
Staff Quarters	151	12.8
Undergraduate Students' Hostel	378	32.0
Post graduate Students Hostel	270	22.8
Off Campus	383	32.4

Electricity consumption pattern among universities

Figure 3 shows electricity consumption pattern among the three universities sampled. The number of end users using electricity for personal computers and lighting in OAU were more compared to other two universities. This may be due to the constant availability of electricity supply to OAU. However, FUTA used electricity for space cooling more than the other two universities, which may be due to building designs without proper provision for adequate natural ventilation and the slightly high degree of hotness usually experienced in Akure when compared to the other locations in the study area.

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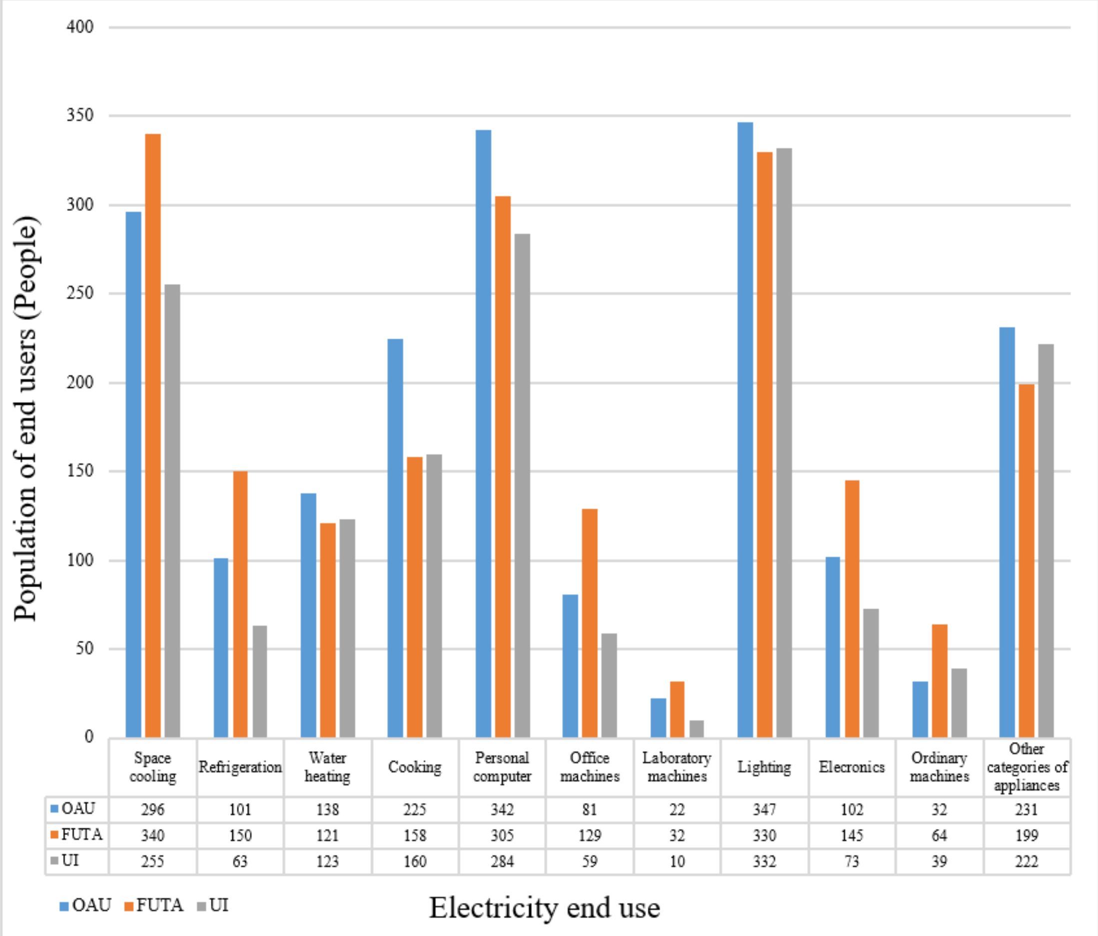

	Space cooling	Refrigeration	Water heating	Cooking	Personal computer	Office machines	Laboratory machines	Lighting	Elecronics	Ordinary machines	Other categories of appliances
OAU	296	101	138	225	342	81	22	347	102	32	231
FUTA	340	150	121	158	305	129	32	330	145	64	199
UI	255	63	123	160	284	59	10	332	73	39	222

Figure 3. End use electricity consumption pattern among universities

In both the wet and dry season, large numbers of electricity end users in FUTA tend to use electricity for achieving various electricity end uses more than other universities as shown in Figure 4. This may also be accounted for, on one hand, by the end users' behaviour to cool rooms than necessary in dry season. On the other hand, preliminary observations showed that A/Cs with capacity higher than the space requirement for cooling were usually installed, indicating that there

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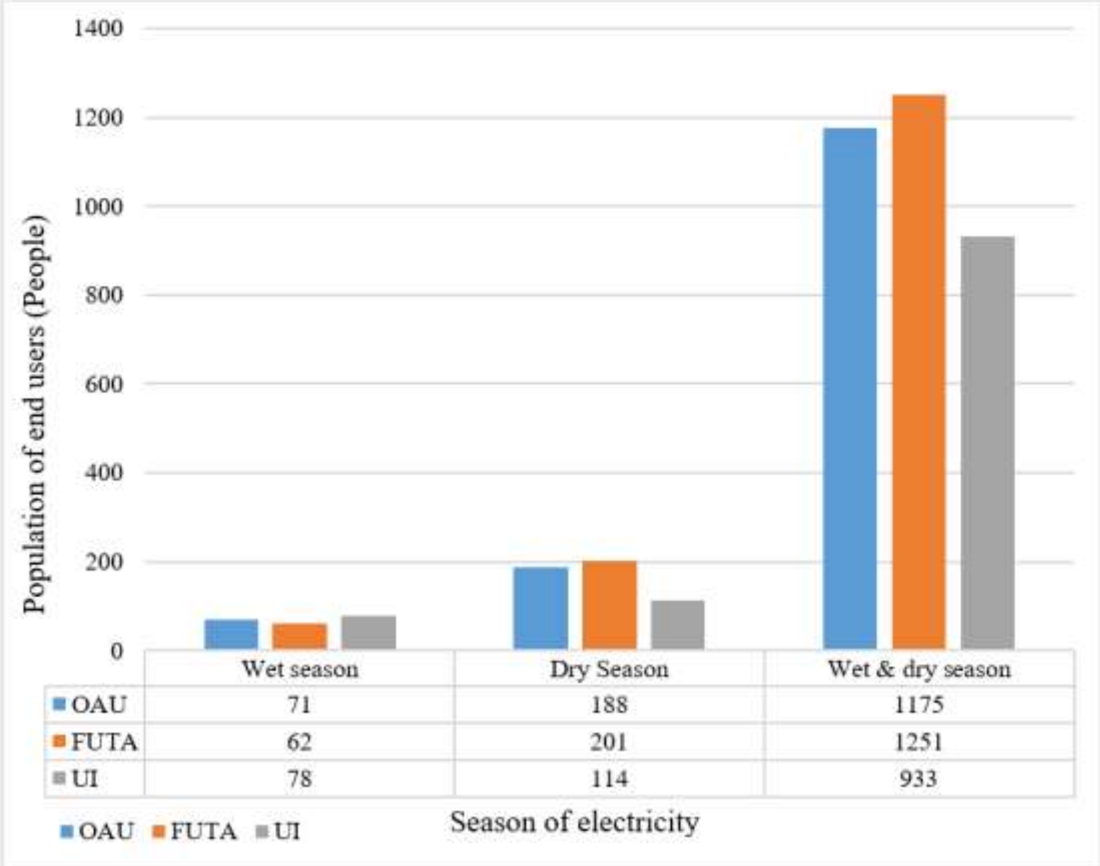

Figure 4. Electricity consumption pattern at different season among the universities

Figure 5 shows the contribution of electricity end users at different time of the day. Results showed that electricity was used throughout the day in these universities. This was expected due to the various electricity based activities in universities at different time of the day. Electricity end users in OAU used electricity at various time of day more than FUTA and UI. This could be due to regular electricity supply to OAU more than FUTA and UI.

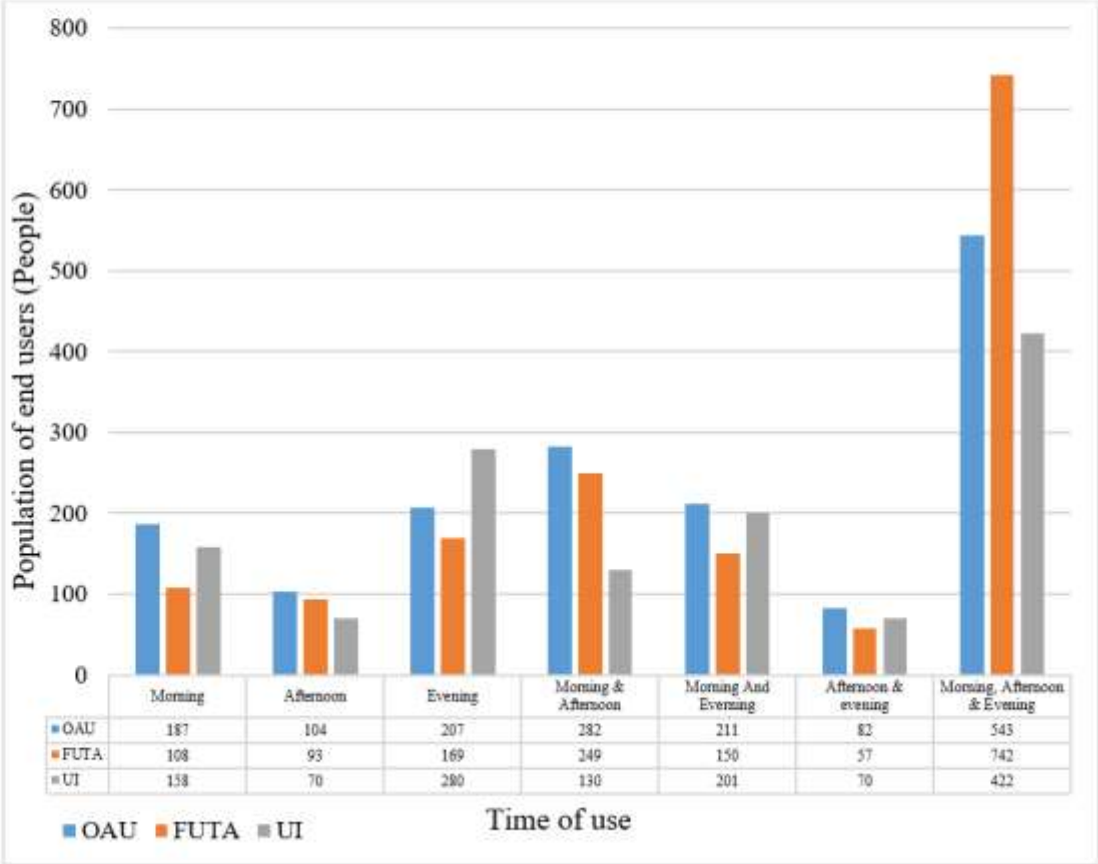

Figure 5. Electricity consumption at different time of the day among the universities

Electricity consumption by equipment type in public universities

Figure 6 shows electricity consumption of different types of electrical equipment in the three universities sampled for the study. Overall, electric cooker consumed electricity more than other equipment. The results (Figure 6) showed that 14.14% of the total electricity consumption of end users investigated was used by electric cooker. This high percentage consumption of electric cooker could be because majority of the electricity end users depend solely on electricity for cooking, especially in student halls. Above 14.07% was consumed by A/C, 8.53% by electric jug, 7.87% by stabilizers, 6.48% by pressing iron, 5.12% by photocopier, 4.51% by electric kettle and 4.17% by printers. However, the results also indicate that there was also some of the electrical equipment that did not consume much electricity. This could be due to the fact that they were not frequently put to use like other high electricity consuming equipment identified in the study. Such less electricity consuming equipment as indicated by the results of this study were heat extractor (0.001%), clipper sterilizer (0.003%) and fax machine (0.008%). Overall, electricity consumption of public university can be adequately lessened by establishing laws that prohibits the use of electric cookers in the students' halls of residence

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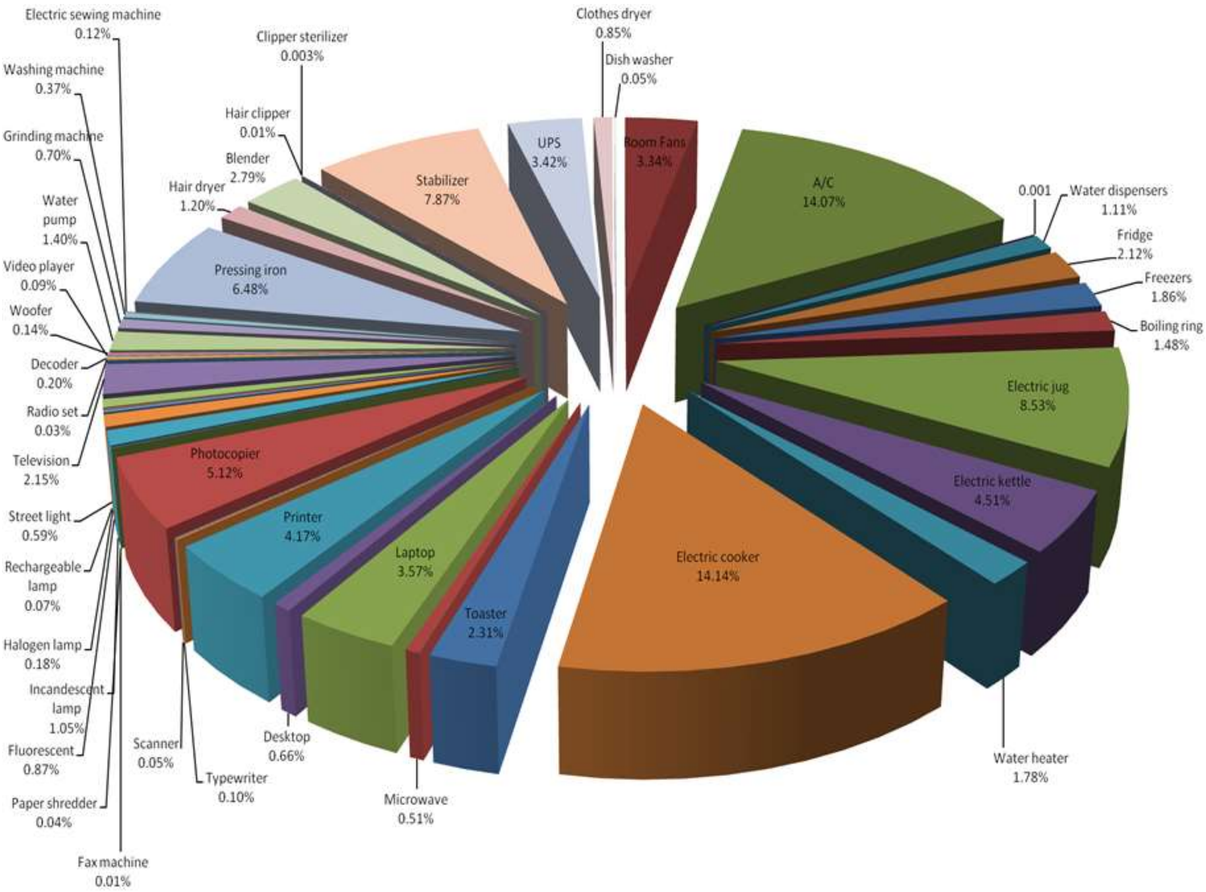

Figure 6: Electricity consumption by equipment type

Proportionate electricity consumption of end users

Figure 7 indicates that out of the total annual electricity consumption in OAU, 51.92% was consumed by students, 29.06% by staff, 12.25% was consumed by staff quarters and 6.77% was consumed by business unit. Similarly, Figure 8 indicates that out of the total annual electricity consumption in FUTA, 43.50% was consumed by students, 42.18% by staff, 8.53% was consumed by staff quarters and 5.79% was consumed by business unit. More so, the percentage annual electricity consumption in UI was 51.92% was consumed by students, 29.06% by staff, 12.25% was consumed by staff quarters and 6.77% was consumed by business unit (Figure 9).

Thus, the results indicate that the business unit consumed the least in all the three public universities studied while students' hostels consumed the most and closely followed by staff offices and staff residence. Expectedly, as in most hostels of university student, this quantity of energy is consumed mostly in electrical appliances such as, electric cookers, lighting, computers, water heaters, fans, deep freezers, fridges, among others. Generally, this indicates that public universities would usually save more than half of the electricity bill when students are on vacation. Therefore, efforts on EM should be directed more to students' hostels to achieve reasonable electricity savings. This result does not favour Unachukwu's (2010) arguments that staff houses consumed electricity the most. However, it is understandable from Unachukwu's (2010) submission that during the period of his study, university staff members were not allowed to take responsibility for managing their energy use, hence, they exhibited indifference to electricity saving. Meanwhile, the outcome of this study also confirms that the business units had recorded least electricity consumption probably because they depend largely on petrol powered generators. The implication of this is noise and air pollution to the environment, which may be dangerous to health of people around. From the foregoing, it is possible to achieve significant electricity savings in Nigerian public universities if necessary measures are taken to ensure end-use energy efficiency including simple housekeeping measures.

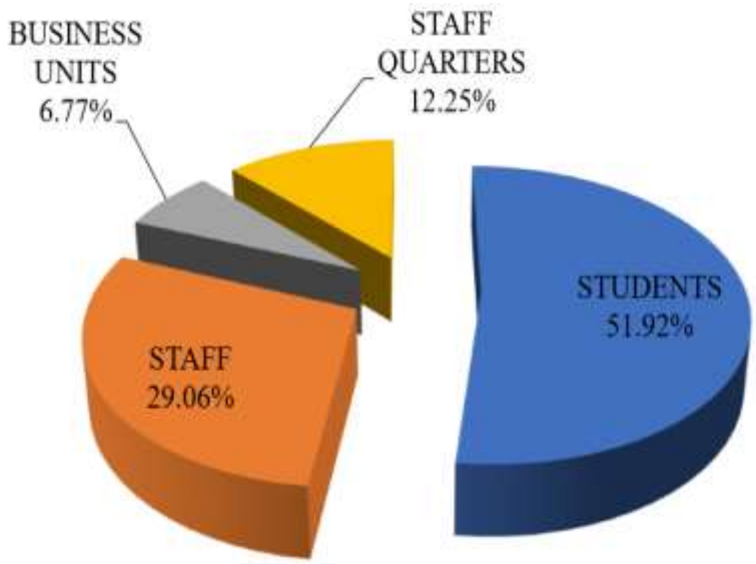

Figure 7. End users' electricity consumption quota in OAU

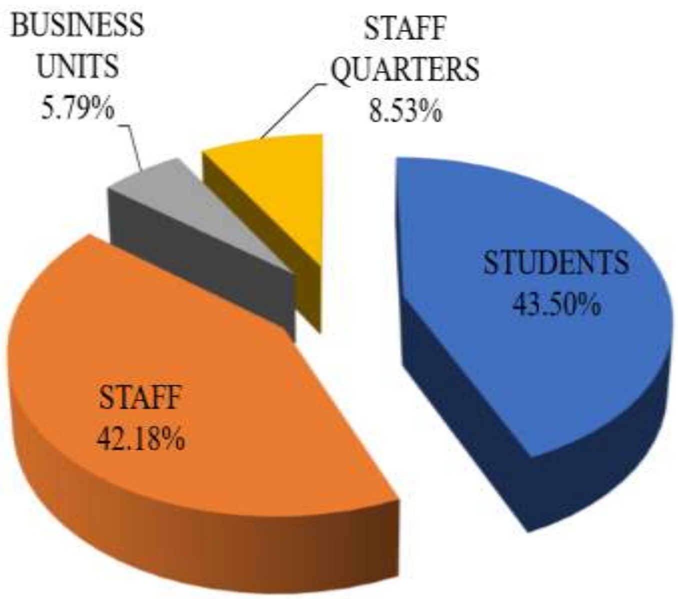

Figure 8. End users' electricity consumption quota in FUTA

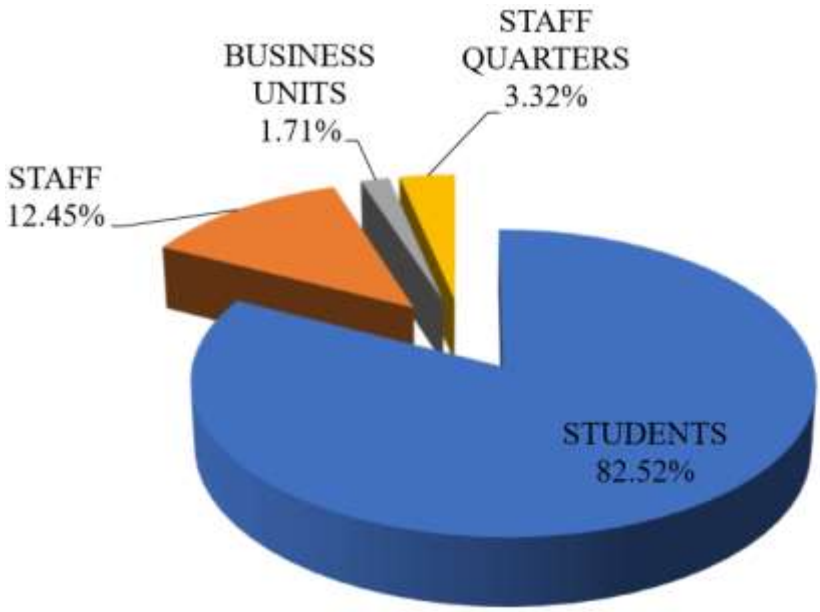

Figure 9. End users' electricity consumption quota in UI

Regression model of electricity consumption

A significant F statistic presented in Table 2 indicated that using the model is better than guessing the mean. The regression does an excellent job of modelling electricity consumption. The coefficient of determination (R^2) = 0.415 in Table 2 shows that 42% of the variation in the electricity consumption was explained by the model. This implies that 42% of the population at the three universities, average capacity of the equipment and average hour of use accounted for electricity consumption. In Table 2, the ANOVA shows that the model is a good predictor of the dependent variable since p-value is less than 0.05 within α = 0.05 level of significance (F = 9.448, degree of freedom (df) = 3 and P = 0.000). Therefore, the model can then be used to predict electricity consumption of public universities.

Table 3 indicates the coefficients derived for the formulation of regression model for predicting electricity consumption in public universities. From Table 3, the intercept coefficient is -234.267 while the slope coefficients are 0.907, 0.317 and 35.694 for each predictor. Moreover, the predictor variables represented as x_1, x_2 and x_3 in equation 1 are population, average capacity of equipment and average hour of use, respectively (Table 3). Furthermore, equation (1) represents the model formulated to predict electricity consumption. However, the electricity consumption of end users in public universities can be predicted using equation (2), assuming the independent variables increase by a unit.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + e$$

$$Y_1 = -234.267 + 0.907X_1 + 0.317X_2 + 35.694X_3 \dots\dots\dots\dots\dots (1)$$

$$Y_2 = -234.267 + 0.907(X_1 + 1) + 0.317(X_2 + 1) + 35.694\,(X_3 + 1) \dots\dots\dots\dots\dots (2)$$

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Table 2. Analysis of variance of regression model of electricity consumption

Model	Sum of Squares	df	Mean Square	F	P-value	R^2
Regression	4584224.234	3	1528074.745	9.448	0.000	0.415
Residual	6469497.369	40	161737.434			
Total	11053721.603	43				

Table 3. Coefficients of regression model

Dependent Variable: Energy Consumption	Unstandardized Coefficients		Standardized Coefficients	t	P-value
	Beta	Std. Error			
(Constant)	-234.267	133.276		-1.758	0.086
Population	0.907	0.296	0.380	3.060	0.004
Average capacity of Equipment	0.317	0.070	0.566	4.517	0.000
Average Hour use	35.694	17.771	0.250	2.008	0.051

CONCLUSIONS

Electricity end use characteristics of three public universities in southwestern Nigeria were investigated. The electricity consumption patterns showed clear seasonal disparities, signifying peak electrical energy demands during the dry season, due to the equivalent cooling requirements. The ranges of percentage electricity consumption for the four stakeholders' groups investigated, namely Staff offices, Business units, staff and students' halls of Residences were 12.45% – 42.18%, 171% – 6.77%, 3.32% – 12.25% and 43.50% – 82.52%, respectively. Analysis of the forty-four key electrical appliances considered in the study suggested that electric cookers, A/C, electric jugs, stabilizers, pressing iron, photocopiers, electric kettles and printers consumed electricity in the order of 14.14%, 14.07%, 8.53%, 7.87%, 6.48%, 5.12%, 4.51% and 4.17%, respectively. Finally, it was found that the regression model developed could predict the electricity consumption of public universities in the study area for every unit increase in the predictor variables

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