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INVESTIGATION OF THE USE OF GENERATING SETS AS ALTERNATIVE SOURCE OF POWER SUPPLY IN RESIDENTIAL BUILDINGS

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ABSTRACT: Epileptic power supply by the service provider has been a major bottleneck in the bid of residential building occupants to use their electrical appliances indoor for comfort drive. Thus, this study is aimed at investigating and analysing usage of generating sets by the building occupants in Ibadan Metropolis, Nigeria. Data were collected by administering questionnaires on the respondents. The 59 political wards in the 5 local government areas of Ibadan Metropolis were stratified into core, transition and suburban residential zones. Twenty five (25) per cent of the wards indicating 15 wards were selected across the three zones. By using systematic sampling technique, 2% of the residential buildings totaling 736 buildings were sampled across the zones. The study revealed that the average duration of power supply that was incidental to dependence on generating sets in residential buildings in the core, transition and suburban zone was 4.37, 5.31 and 7.63hrs respectively. Also, 45.82% of the respondents had used their generating sets for 3 years; 93.78% largely depended on petrol engine generators; and 71.43% of the respondents could not use their generating sets to power all their electrical appliances at a moment when compared with the normal voltage of power from the service provider (IBEDC). The study concluded that the type of generating used depended on the socio-economic characteristics of the respondents and recommended that government should ensure sincere deregulation of power sector and seek for more environmentally energy sources.

KEYWORDS: Electricity, Poor Supply, Generating Sets, Types, Brand.

1 INTRODUCTION

Availability of electricity is crucial for commercial activities, technological advancement and comfort drive of building occupants. Erratic power supply is a major challenge in Nigeria as its energy infrastructure has experienced series of ups and downs (Adewoye, 2007; Sambo, 2008; and Subair and Oke, 2008). According to World Bank Report (2001), in two decades' time, Nigeria's population will likely double. With modernization, electricity use has become an essential need for most people in developing countries. Most towns and cities in Nigeria are connected to the national power grid. However, supply from the national grid has become a major problem for about a decade and people have to seek for alternative sources of power supply. In 1999, the power generated in Nigeria was 1,500 MW, and currently about 2,030 MW which is far short of the projected energy demand of 107,600 MW by 2020 with the growth rate of the country at 13% (Sambo *et al.*, 2009; TCN, 2016).

According to World Bank Report (2001), in two decades' time, Nigeria's population will likely double. In the absence of a comprehensive overhaul of energy policy and regulatory framework, more Nigerians, will in the future, be without electricity (Chidiezie and Igwiro, 2008). The unreliability of electricity supply in Nigeria has been a serious challenge to its economic development and environmental sustainability (Oyedepo, 2014). This has forced most Nigerians to look for alternative power supplies (Ibitoye and Adenikinju, 2007). Available statistics show that 60 per cent of Nigeria population lack access to electricity for their needs (Baker Institute Energy Forum, 2008). The shocks from the energy crisis in Nigeria have created some wedges in the national wheel of the effective management of industrial and other socio-economic programmes. Over

167 million people of Nigeria are depending on less than 3,000 to 5,000 MW of electricity with the recurrent multiple and unpredictable power outages. In view of this, there is a paradigm shift of building occupants to dependence on off-grid power supplies which involves the use of generators of different types and capacities. This development has made the country to be running "generator economy" (Ahmad and Abubakar, 2012).

While trying to address problems of electricity supply, building occupants across the globe have been adopting principle of off-grid power supplies, micro generation of power through the use of micro hydro plants, wind power plants, biogas plants, generators and photovoltaic (PV) plants (Harrison, 2008). In Nigeria, many people, companies and institutions supplement the grid system with their own generators. Indeed, those who could afford a generator own one. This is noticed in the use of different types of generators; petrol or diesel powered generators by occupants of different types of buildings and well over 90% of businesses in Nigeria have generators (World Bank, 2005). Studies on generating sets used in buildings in Nigeria such as Komolafe, 2011 and Sonibare *et al*. 2014, and in particular, the study area have not focused on generator audit that involves its types, brand and cost of generators used. In view of the gaps identified, the specific objectives of the study are to identify and examine types of generating sets used in residential buildings in Ibadan Metropolis.

2 THE STUDY AREA

Ibadan is an urban centre located in the humid southwest of Nigeria and is the capital city of Oyo State. It is on major transport routes to Lagos, northern parts of Nigeria and is the largest of the contemporary traditional Yoruba towns. The geographical location of Ibadan falls between coordinates $7^{o}\ 22^{'}\ 47^{''}$ North of the Equator and $3^{o}\ 53^{'}\ 0^{''}$ East of the Greenwich Meridian. The total population of Ibadan according to FGN (2009) is 2,559,853 including population of the surrounding towns and villages. The city ranges in elevation from 150 m in the valley area to 275 m above sea level on the major north-south ridge which crosses central part of the city. The city is characterized by a warm rainy season between 100 mm to 200 mm of annual rainfall extending from March to October, and a constantly high temperature of 24 ^{o}C to 27 ^{o}C.

The entire area of Ibadan is largely well-drained, though many of its rivers are seasonal. Developed land increased from only 100 ha in 1830 to 12.5 Km^2 in 1931, 30 Km^2 in 1963, 112 Km^2 in 1973, 136 Km^2 in 1981 and 214 Km^2 in 1988 (Mabogunje, 1968). Measured from the General Post Office in the Central Business District, the city has sprawled out of the radius of 12-15 Km along the primary roads. The city's metropolitan region covers about 4200 Km^2 with boundaries varying from 17 Km in south-west to 44 Km in the north-east. Ibadan consists of eleven local government areas, five in the city and six in the suburb. The five local governments that form the city cover about 15% of the total land areas of Ibadan, while the remaining 85% is for the remaining six local governments in the suburb. Ibadan North Local Government has the largest area among the local governments with 145.58 Km^2 while Ibadan North West is the smallest with 31.38 Km^2 (Oyo State Ministry of Local Government and Chieftaincy Matters, 2012).

3 RESEARCH METHODOLOGY

The sample frame for the study was made up of residential buildings that existed in the selected five local governments of Ibadan Metropolis. Multi-stage sampling technique was employed for the study. The first stage involved delineation of residential areas in Ibadan Metropolis into three different zones, core, transition and suburban; based on age and other criteria. The technique of delineating residential areas in Nigeria involves the use of historical and physical attributes. It takes into consideration, period of the emergence of a city or a section of a city, housing characteristics, environmental qualities and population per square kilometer (density) among others (Afon, 2008; Wojuade, 2012; Adigun 2013). The second stage involved the use of stratified random sampling technique by taking 25% sample in each of the residential zones, and thus representing selection of 15 out of the 59 residential/political wards of the study area. According to Singleton *et al*. (1988), stratified random sampling technique could be used when each stratum is homogeneous. Systematic sampling technique was used in the third stage whereby 2 per cent of the total number of buildings in the selected wards was sampled in accordance with Singleton *et al*. (1988) which stated that the greater the heterogeneity of the population, the larger the sample needed to achieve a given level of reliability. Based on the use of 2 per cent of the total number of buildings in the residential zones of the study area, a total number of 736 residential buildings were thus sampled.

The research was conducted by the use of both structured and semi-structured questionnaires administered on the respondents in the residential buildings sampled to collect information on the variables associated with the generators used by the respondents. It was complemented by structured site observations and interview process. Both descriptive and inferential statistics were used in analysing the data collected for this study. Socio-economic issues and rate of power outages incidental to the type, mode and use of generating sets were analyzed by using frequency distribution, Duncan Multiple Range Test and one-sample binomial test.

4 Results And Discussions

Table 1 shows that out of the 736 questionnaires administered on the users of generators in residential buildings, 443 questionnaires were returned and found useful for analysis. This indicated a return rate of 60.19%. According to Babies (2005), a response rate of 40% was adjudged adequate for studies in built environment related researches, and this implies, that the 60.19% return rate ought to be substantial to adequately reinforce findings of the study.

Table 1: Return Rate of the Questionnaires Administered

Users of Generators	Frequency	Percentage (%)
Number unreturned/not properly completed	293	39.81
Number returned and properly completed	443	60.19
Total	736	100.00

Profile of the Respondents

Table 2 shows the profile of respondents sampled in residential buildings in the study area. The age distribution of the respondents showed that bulk of respondents in the residential buildings across the zones belonged to the 31-40 age group (37.50%) and was followed by the 41-50 age group (33.80%) while the age group that was greater than 60 years (4.70%) had the least number of respondents. The implication of this is that, the respondents sampled in the study area were active, vibrant and ought to be in possession of fundamental household items like generating sets needed for occupants' comfort drive. It is shown that 55.88% of the users were self-employed, 35.05% were employed and 9.07% were senior citizens who had retired from either private or public service. It was obtained that employed respondents existed across the three residential zones of the study area as there were 24.84% in the core, 38.46% in the transition and 45.30% in the suburban residential zone. The educational status of respondents in residential buildings revealed that 61(44.20%) of respondents in the transition zone had senior secondary education, 60(43.50%) had post-secondary education and 10(7.20%) had postgraduate qualification. In the suburban residential zone, 41(34.70%) had post graduate education which indicated that they were most educated. Comparably, in the core residential zone, 25(14.70%) and 108(63.50%) of its respondents had adult/primary and senior secondary school education respectively. Since it was found that it was in the suburban residential zones where the respondents were mostly educated, this indicates that the level of education of respondents which was most significant in the suburban residential zone in the study area would affect their socio-economic characteristics, particularly on the type and rate of the use of generating sets in their buildings. Table 2 shows that bulk of respondents in the suburban residential buildings 32(29.09%) earned more than 120,000 naira monthly while respondents in the transition residential zone had reduced response rate of 4(2.94%). It also indicated that, it was in the core residential zone, where its majority, 111(63.07%) of its respondents earned below 30,000 naira monthly, and 65(36.93%) of its respondents earned between 30,000 to 60,000 naira monthly. However, in the transition and suburban zones, 69(50.74%) and 14(12.73%) of their respondents respectively earned between 30,000 to 60,000 naira. This implies that earning power of respondents in the suburban residential buildings was significantly higher than others in the transition and core residential zones. There was unequitable occupancy status of respondents sampled in the residential buildings as bulk of respondents in all the zones were landlords in their personal buildings with response rate of 94(52.81%), 91(65.47%) and 71(57.72%) for core, transition and suburban residential zone respectively. It further revealed that fewer number of respondents were tenants in the buildings selected as the core zone had the highest frequency rate of 84(47.19%) followed by suburban 52(42.28%) and transition zone 48(34.53%) respectively. It is thus expected that, with the majority of the respondents being landlords in the selected buildings, their propensity to use building service items ought to be very high.

Table 2: Profile of Respondents Sampled in the Residential Buildings

Characteristics	Residential Buildings							
	Core Zone		Transition Zone		Suburban Zone		Total	
	F	(%)	F	(%)	F	(%)	F	(%)
Age (Yrs)								
21-30	22	(12.50)	22	(16.40)	5	(4.20)	49	(11.40)
31-40	73	(41.50)	50	(37.30)	38	(31.90)	161	(37.50)
41-50	56	(31.80)	41	(30.60)	48	(40.30)	145	(33.80)
51-60	18	(10.20)	15	(11.20)	21	(17.60)	54	(12.60)
> 60	7	(4.00)	6	(4.50)	7	(5.90)	20	(4.70)
Total	176	(100.00)	134	(100.00)	119	(100.00)	429	(100.00)
Employment								
Employed	40	(24.84)	50	(38.46)	53	(45.30)	143	(35.05)
Self Employed	107	(66.46)	70	(53.85)	51	(43.59)	228	(55.88)
Retired	14	(8.70)	10	(7.69)	13	(1.11)	37	(9.07)
Total	161	(100.00)	130	(100.00)	117	(100.00)	408	(100.00)
Education								
Adult/Primary	25	(14.70)	4	(2.90)	0	(0.00)	29	(6.80)
Junior Secondary	23	(13.50)	3	(2.20)	0	(0.00)	26	(6.10)
Senior Secondary	108	(63.50)	61	(44.20)	19	(16.10)	188	(44.10)
Post Secondary	14	(8.20)	60	(43.50)	58	(49.20)	132	(31.00)
Post Graduate	0	(0.00)	10	(7.20)	41	(34.70)	51	(12.00)
Total	170	(100.00)	138	(100.00)	118	(100.00)	426	(100.00)
Income								
< N30,000	111	(63.07)	49	(36.03)	13	(11.81)	173	(40.99)
N30,000-N60,000	65	(36.93)	69	(50.74)	14	(12.73)	148	(35.08)
N61,000-N90,000	0	(0.00)	12	(8.82)	24	(21.82)	36	(8.53)
N91,000-N120,000	0	(0.00)	2	(1.47)	27	(24.55)	29	(6.87)
> N120,000	0	(0.00)	4	(2.94)	32	(29.09)	36	(8.53)
Total	176	(100.00)	136	(100.00)	110	(100.00)	422	(100.00)
Occupancy								
Landlord	94	(52.81)	91	(65.47)	71	(57.72)	256	(58.19)
Tenant	84	(47.19)	48	(34.53)	52	(42.28)	184	(41.81)
Total	178	(100.00)	139	(100.00)	123	(100.00)	440	(100.00)

IDENTIFICATION AND EXAMINATION OF GENERATING SETS USED IN RESIDENTIAL BUILDINGS

The menace of power outage that led to dependence on generators, and the interrelated issues of generator audit that focuses on the type, brand, ratings of generators used, years of use (age) of the generators, cost of fuelling of the generators and the capacity of generators to power all appliances used indoor relative to electricity supply by the Ibadan Electricity Distribution Company (IBEDC) were investigated. The rate of supply of electricity to the buildings sampled is shown in Table 3. There was disproportionate supply of power by IBEDC to the various residential zones in the study area. The result revealed that the average duration of supply of electricity to residential buildings was 4.37, 5.31 and 7.63 hours daily in the core, transition and suburban zones. The result substantiated findings of Baker Institute of Technology (2008), Subair and Oke (2008), World Bank (2005) that most cities in Nigeria rarely had stable power supply from the power authority. Also, according to NERC (2015), the daily supply of power to buildings in the country dropped to an average of 5.86 hours daily. This implies that the dire need of building occupants was significantly affected by the epileptic power supply. The ANOVA test established a variation of $F = 44.599$, $p < 0.05$. By implications, the ANOVA test established a significant relationship between the average number of hours of availability of electricity and zones of residences. Further examination carried out by using Duncan Multiple Range Test (DMRT) revealed that there were significant differences in the availability of electricity in the core, transition and suburban zones (Table 4). The study also showed that the supply was quite erratic in some zones as it was found that they were not supplied with electricity which made their neighbourhood to be in a perpetual state of blackout.

Table 3: Rate of Supply of Electricity to the Residential Buildings

Sampled Building	Core Zone Hrs	Transition Zone Hrs	Suburban Zone Hrs
Residential Building	4.37	5.31	7.63

Table 4: Duncan Multiple Range Result of Supply of Electricity to Residential Buildings

Residential Zone	N	Mean	Std. Deviation	Std. Error	Maximum	Minimum
Core Zone	168	4.3750a	1.68006	.12962	2.00	8.00
Transition Zone	136	5.3162b	2.46066	.21100	2.00	12.00
Suburban Zone	123	7.6341c	4.41731	.39830	.00	22.00
Total	427	5.6136	3.22885	.15625	.00	22.00

Note: Alphabets a, b and c indicate significant differences at 0.05 level of significance.

Table 5 shows years of use (age) of the generators used by the respondents in the study area. It is shown in Table 5 that approximately 45% of respondents, 61 (46.92%), 56 (45.16%) and 53 (45.30%) in residential buildings of the core, transition and suburban zone respectively had been using their generating sets for an average of 3 years. In the same fold, it was found that across residential buildings of the study area, 45.82% of the respondents had been using their generators for 3 years, 25.88% (2 years), 14.82% (1 year) and 6.74% (4 years). The Chi-square test indicated that there was significant relationship in the years of use of generators in the buildings ($\chi^2 = 11.427$, $p = 0.325$). It was also found during the interview that a large number of the respondents in the residential buildings across zones of the study area had used different generating sets for an average of 3 years which is comparable to the results of the questionnaires administered. The implication of this is that the dependence of majority of the respondents on generators running for years shows that they run generator economy as found in the works of (Ibitoye and Adenikinju, 2007; Ahmad and Abubakar, 2012; BBC Africa, 2013).

Table 5: Years of Use (Age) of the Generators by the Respondents

Years of Use	Residential Buildings						Total	
	Core Zone		Transition Zone		Suburban Zone			
(Yr)	F	(%)	F	(%)	F	(%)	F	(%)
1 Yr	18	(13.85)	23	(18.54)	14	(11.97)	55	(14.82)
2 Yrs	36	(27.69)	28	(22.58)	32	(27.35)	96	(25.88)
3 Yrs	61	(46.92)	56	(45.16)	53	(45.30)	170	(45.82)
4 Yrs	8	(6.15)	6	(4.84)	11	(9.40)	25	(6.74)
5 Yrs	4	(3.08)	9	(7.27)	2	(1.71)	15	(4.04)
> 5 Yrs	3	(2.31)	2	(1.61)	5	(4.27)	10	(2.70)
Total	130	(100.00)	124	(100.00)	117	(100.00)	371	(100.00)

The core part of results of the study on generator audit that deals with the type, brand, output rating, cost of use/fuelling and capacity of the generating sets used by the respondents are as presented. Table 6 shows that 12(9.68%) of respondents in residential buildings in the suburban zone used diesel engine generators while 9(6.37%) and 4(2.94%) in transition and core zone respectively used it. This indicated that socio-economic level of the respondents in the suburban zone which was significantly higher than respondents in other zones' residential buildings accounted for this prevalence. As depicted in Table 6, petrol engine generators were significantly used by respondents in residential buildings across the zones sampled by 132(97.06%), 133(93.66%) and 112(90.32%) in the core, transition and suburban zone respectively. The results of the Chi-square tests revealed that there was a significant relationship between the type of fuel of generating sets used in the residential zones and occupancy status of the respondents in Ibadan ($\chi^2 = 19.009$, $p < 0.001$). Table 6 also shows through the one-sample binomial test that at a 2-tailed significance level, there was significant probability of 0.94 of the use of petrol engine generators in the residential buildings. Tyler (2002) in his study found that 96 to 98% of outlets in the country have private generators used as alternative source of power supply. From these, there was wide use of various types of generators and thus underpinning the statement, that many geographical locations in the country run "generator economy".

Table 6: Type of Fuel of the Generators Used by the Respondents

Type of Fuel of the Generator	Residential Buildings						Total	
	Core Zone		Transition Zone		Suburban Zone			
	F	(%)	F	(%)	F	(%)	F	(%)
Petrol	132	(97.06)	133	(93.66)	112	(90.32)	377	(93.78)
Diesel	4	(2.94)	9	(6.37)	12	(9.68)	25	(6.22)
Total	136	(100.00)	142	(100.00)	124	(100.00)	402	(100.00)

One-Sample Binomial Test on the Type of Generators Used				
Type of Fuel of the Generator	N	Observed Prop.	Test Prop.	Exact Sig. (2.tailed)
Petrol	377	.94	.50	.000
Diesel	25	.06		
Total	402	1.00		

The study examined brand of generating sets used by the respondents sampled in the study area. Table 7 shows that in residential buildings in the core zone, a large number of the residents 32(24.06%) used Tiger brand, 23(17.29%) used Elemax brand, while in the transition zone, a sizeable number of the respondents, 29(22.14%) used Elemax brand followed by Tigmax brand 27(20.61%). However, in the suburban zone of the study area, an almost similar result was found with a large proportion of the respondents 26(22.03%) used Elemax brand and closely followed by 24(20.34%) that used Elepaq brand of generator set. As also shown in Table 7, in residential buildings across zones of the study area, Elemax brand of generator was largely used by the respondents 78(20.42%), followed by 65(17.01%) that used Tiger brand of generator. The brand of generators procured and used by the respondents in the residential buildings was found to depend largely on their perception about their efficiency and this informed the variation in the brand used. The Chi-square test also indicated that there was significant relationship in the brand of generators used in the buildings sampled ($\chi^2 = 30.803$, $p = 0.06$). Table 7 also shows through the one-sample binomial test based on the 2-tailed level that there was significant probability (0.20) of the Elemax brand of generating sets in the residential buildings. It was followed by Tiger brand with probability (0.17) and Elepaq (0.15). The result of this study based on the procurement and use of different brand of generating sets substantiated findings of Ahmad and Abubakar, 2012 and the World Bank, 2005 that the country is a market hub for generating sets is evident in the importation of different types and make of generating sets massively used by the populace in the face of poor power supply by the service provider.

Table 7: Brand of Generators Used by the Respondents

Brand of the Generating Sets	Residential Buildings						Total	
	Core Zone		Transition Zone		Suburban Zone			
	F	(%)	F	(%)	F	(%)	F	(%)
Yamaha	5	(3.76)	2	(1.53)	2	(1.69)	9	(2.36)
Thermocool	4	(3.00)	3	(2.29)	8	(6.79)	15	(3.93)
Honda	9	(6.78)	2	(1.53)	4	(3.39)	15	(3.93)
Tiger	32	(24.06)	17	(12.98)	16	(13.56)	65	(17.01)
Tigmax	14	(10.53)	27	(20.61)	12	(10.17)	53	(13.87)
Elemax	23	(17.29)	29	(22.14)	26	(22.03)	78	(20.42)
Elepaq	15	(11.28)	19	(14.50)	24	(20.34)	58	(15.18)
Sumec	12	(9.02)	14	(10.68)	8	(6.78)	34	(8.90)
Firman	7	(5.26)	3	(2.29)	7	(5.93)	17	(4.45)
Lutian	5	(3.76)	6	(4.58)	5	(4.24)	16	(4.19)
Imex	7	(5.26)	9	(6.87)	6	(5.08)	22	(5.76)
Total	133	(100.00)	131	(100.00)	118	(100.00)	382	(100.00)

One-Sample Binomial Test on the Brand of Generating Sets Used

Brand of the Generating Sets		N	Observed Prop.	Test Prop.	Exact Sig. (2.tailed)
Group 1	Elemax	78	.20	.50	.000
Group 2	Tiger	65	.17		
Group 3	Elepaq	58	.15		
Σ(Other Brand)		181			
Total		382	1.00		

The output ratings of generating sets based on the standardized ratings and classifications that existed in the sales outlet during the preliminary survey are presented in Table 8. The Table shows that in the suburban residential buildings, 54(47.79%) of the respondents significantly used petrol generating sets of rating limits (2.8-5.5 KVA) than those in other zones, and the use of diesel engine generators was also most prevalent in the suburban zone than what obtained in the other two zones (Table 5). The Chi-square test indicated that there was significant relationship in the ratings of petrol and diesel engine generators used in the residential buildings ($\chi^2 = 82.048$, $p < 0.001$). Table 8 also reveals through the one-sample that there was significant probability (0.68) of the use of petrol engine generators of 0.65-1.2 KVA in the core zone, (0.34) of 1.2-2.8KVA in the transition zone and (0.49) of 2.8-5.5 KVA in the suburban zone respectively. However the observed probability of the use of petrol engine generators in the residential buildings across the zones of the study area is 0.95.

Table 8: Ratings of Generators Used by the Respondents

Ratings of the Generators (KVA)	Residential Buildings						Total	
	Core Zone		Transition Zone		Suburban Zone			
	F	(%)	F	(%)	F	(%)	F	(%)
Petrol Engine (KVA)								
0.65 – 1.2	102	(60.36)	40	(29.63)	8	(7.08)	150	(35.97)
1.2 – 2.8	53	(31.36)	54	(40.00)	51	(45.13)	158	(37.89)
2.8 – 5.5	14	(8.28)	41	(30.37)	54	(47.79)	109	(26.14)
Total	169	(100.00)	135	(100.00)	113	(100.00)	417	(100.00)
Diesel Engine (KVA)								
7.5 – 10	1	(100.00)	5	(83.33)	13	(92.86)	19	(90.48)
10 – 15	0	(0.00)	0	(0.00)	0	(0.00)	0	(0.00)
15 – 20	0	(0.00)	1	(16.67)	1	(7.14)	2	(9.52)
> 20	0	(0.00)	0	(0.00)	0	(0.00)	0	(0.00)
Total	1	(100.00)	6	(100.00)	14	(100.00)	21	(100.00)

One-Sample Binomial Test				
	N	Observed Prop.	Test Prop.	Exact Sig. (2-tailed)
Petrol	417	.95	.50	.000
Diesel	21	.05		
Total	438	1.00		

Table 9 shows the use of generating sets by respondents in the study area when the price of petrol was 87 naira per litre in the study area before the sudden increase in its price due to scarcity and further deregulation of the petroleum sector by the federal government of Nigeria which led to higher increase in its price. A large proportion of respondents, 81(66.39%) in the suburban residential buildings spent between 5,100 to 7000 naira monthly on the cost of fuelling their generators. A contrast in the economy of use was found among respondents in the core zone as 117(66.86%) and 53(30.29%) of the respondents spent up to 1000 naira and between 1,100 to 3000 naira monthly respectively, while majority of respondents, 97(70.80%) in the transition zone spent between 1,100 to 3,000 naira monthly. It was also found that the mean amount spent on the fuelling of generators were 1,450, 2,955 and 5,975 naira in the core, transition and suburban zone respectively. This also reveals that the income level of respondents influenced how they lived in the suburban zone by using generating sets of higher output ratings and more appliances than those living in other zones.

Table 9: Cost of the Use of Generators by the Respondents

Amount Spent (Naira)	Residential Buildings						Total	
	Core Zone		Transition Zone		Suburban Zone			
	F	(%)	F	(%)	F	(%)	F	(%)
≤ 1,000	117	(66.86)	31	(22.63)	0	(0.00)	148	(34.10)
1,100 - N3,000	53	(30.29)	97	(70.80)	6	(4.92)	156	(35.95)
N3,100 – N5,000	4	(2.29)	9	(6.57)	26	(21.31)	39	(8.99)
N5,100 – N7,000	1	(0.56)	0	(0.00)	81	(66.39)	82	(18.89)
N7,100 – N9,000	0	(0.00)	0	(0.00)	9	(7.38)	9	(2.07)
> N9,100	0	(0.00)	0	(0.00)	0	(0.00)	0	(0.00)
Total	175	(100.00)	137	(100.00)	122	(100.00)	434	(100.00)

The study revealed that in the residential buildings, 25(23.36%) of generating sets of respondents in the suburban zone had capacities to power all their appliances when compared with the full supply of voltage of electricity from IBEDC as shown in Table 10. Majority of the respondents, 107(70.40%), 61(67.03%) and 82(76.64%) in the core, transition and suburban zone respectively as 250(71.43%) in all zones could not use their generating sets to power all their appliances when compared with the supply of electrical energy of adequate voltage to their buildings. These results further substantiated the position ascribed to the country in being a generator-economy nation because dependence of the respondents on varying capacities of the available generators have not been able to give building occupants the much needed satisfaction as an alternative power supply in the face of the current epileptic power supply.

Table 10: Capacity of the Generators in Powering All Electrical Appliances Used Indoor

Residential Building Sampled	Response on Capability of Generating Sets to Power All Electrical Appliances Used Indoor				Total	
	Yes		No			
	F	%	F	%	F	%
Core Zone	45	29.60	107	70.40	152	100.00
Transition Zone	30	32.97	61	67.03	91	100.00
Suburban Zone	25	23.36	82	76.64	107	100.00
Total	100	28.57	250	71.43	350	100.00

5 Conclusion And Recommendations

The study found that limited availability of adequate quality and quantity electricity has been an unresolved national issue in the power sector of the economy. Findings of the study revealed that the crave of occupants of residential buildings to get comfort drive indoor has forced them to depend on varying types and brand of generating sets for their daily needs. The generator audit carried out across zones of the study area reflected sharp variation in its types, output ratings and socio-economic characteristics of the respondents. It was revealed that sizeable number of residential buildings' respondents, 47.79%, in the suburban zone used generating sets that were of significantly higher output ratings than those used in either core or transition zone. It was established that 23.36% of respondents of respondents in the suburban zone were capable of powering all the electrical appliances used when compared with when they used to get adequate supply of electricity from the Ibadan Electricity Distribution Company. Majority of respondents, 71.43% in all the residential buildings could not use their generators to power all their electrical devices simultaneously. Against the backdrop of the findings of the study, government should ensure sincere deregulation and privatization of power plants and its associated structures so that the on-going reforms in the power sector of the economy can see light of the day. Efforts should also be intensified on how to harness environmentally friendly and alternative sources of energy that will ensure sustainability of the environment and improve comfort drive of the building occupants.

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