IOSR Journal of Engineering (IOSRJEN) **www.iosrjen.org**
ISSN (e): 2250-3021, ISSN (p): 2278-8719
Vol. 09, Issue 8, August. 2019, ||Series -II || PP 13-26

The Effect of Power Failure on Commercial Consumers within Port Harcourt Garden City, Rivers State.

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Received 15 August 2019; Accepted 30 August 2019

Abstract: Electrical power disruptions have been a major limitation in our society Nigeria, as it has impact in our social-economical activities. This paper will critically examine the problems and costs related to the effect of power failures on commercial customers in Garden City Central Area of Port Harcourt, Rivers State. This work examine problems of electrical power transmission and distribution that influences power failures to commercial consumers with specific interest on mobile telecommunication firms within Garden City Central Area of Port Harcourt, Rivers State. Bearing in mind the model employed in analysis of power failures within Garden City Central Area, of Port Harcourt, Rivers State. It has been discovered that the power failure within the case study area is evenly distributed, thereby reducing cost on the commercial customers. Pearson's correlation coefficients will be used in the cost analysis of comparing power from individual generating set and power from national grid. This work examines commercial power consumption connected to National electricity network (PHEDC) in Garden City Central Area of Port Harcourt, Rivers State. It analyses the cost implication of power supply outages for mobile telecommunication firms using Pearson's correlation factor and the frequency distribution of the outage by a statistical model and recommendations are made.

I. INTRODUCTION

Nigeria is hugely blessed with vast assets that include oil, petroleum gas, coal, biomass, sun powered, wind and hydro assets among others (Iwayemi, 2008). However, despite this enormous enrichment Nigeria is additionally anenergy inadequate nation whose economy experiences colossally the lack of power supply (Iwayemi, 2008). The deficiency forces mammoth cost on the economy and urges across the board private arrangement by various classes of energy clients (Lee &Anas, 1998; Adenikinju, 2005). Furthermore, Nigerians frequently spend long profitable hours lining for oil based goods in the gas stations to purchase gas at government directed costs since gas supply shortage has been an intermittent component of the Nigerian vitality showcase. Gas shortage in the economy and fizzling power supply make double energy emergency for Nigeria (Iwayemi, 2008). Small Scale organizations experience the ill effects of Nigeria's electric power destitution as they spend an extensive extent of their capital (around 20-25% of their speculation) on move down creating offices (Lee & Anas, 1991). Truth be told, Iwayemi, (2008) connects the majority of the nation's monetary burdens including its powerlessness to industrialize to the horrid execution of the energysector. However, control power supply blackouts are not exceptional to creating nations alone considering the current power outages in California and different parts of north Western United States of America. Despite the fact that it has been the cardinal arrangement of government power strategy and customers longing to have control power supply unwavering quality, keeping the light on is an amazingly troublesome test (DOE, 2003) particularly in a creating economy.

Electric power obtrusion takes place when a system ability, because ofextreme power failures in that it cannotmeet the system load levels. The implication of power failure lead to loss of income, loss future sales and increase in repairs and maintenance on the utility company and theirend users.

The cost usually incurred form a small part of the entire cost of the outages.The greater part is borne by the customers,due to the impact on the business. The power failure cost is a precursor of various situations which are deliberated in the sub-sections below. The issue of estimating outage costs is affected by the identified cost of an electric outage, the moment the consumer like to buy electric energy and is unable to do so. The different classes of customer will condone loss of service differently. A private consumer may experience a huge deal of hardship if this outage occurs during hot summer day or while he is engaging in domestic activities but it may be in a little inconvenience to an end user who is forced to close his business until power is restored.

Outage might cause a great loss to the end user, if this occur during production process. Therefore, consumers do not ascertain service interruption to the extent of hardship. The cost depends on availability of the substitute source of power at the time of service interruption. An unexpected outage of electricity might result in great loss on the part of the customer.

However if enough warning is given, the end user may have time to avert or mitigated the loss which might have occur because of unexpected power outage. As the outage linger longer a larger part of private and commercial consumers will be affected and this will directly impact on commercial activities which might in turn lead to anxiety, loss of product, food spoilage and dangerrelated to health.
The real aspect of power failure costs estimation is to do assessment worth of power system reliability, to compare it with the price of power system, this will aid in establishing the reliability of the power system level.

A. CLASSES OF POWER OUTAGE

Below are the classes of power outages (PHEDC, 2017)
(i) Emergency Outages
(ii) Forced Outages
(iii) Planned Outages

i. Emergency Outages:

These types of outages are normally initiated by a qualified PHEDC official under emergency situation to avert danger in the network which may be due to the removal of temporary load (Load Shedding) or it might be attributed to poor voltage supply by the generation company.

ii. **Forced Outages:**

These occur due to faulty situation in the network and these is normally initiated by electronics sensing device called the relay. Its might be due to the overloading from a customer or branch of the network.

iii. Planned Outages:

These type of power failures is normally initiated by PHEDC to undertake maintenance on the generation, distribution and transmission equipment. The time frame for this type of outages is always stipulated. These is to enhanced effectiveness of the system (PHEDC, 2017). Similarly, in transmission stations, bulk transformers, isolators, protective and communication device are often scheduled for maintenance, to enhance efficiency (PHEDC, 2017). The fault can lead to maintenance, reconstruction or repair done on the network (PHEDC, 2017).

B. TYPES OF DANGERS CAUSED BY ELECTRICAL POWER SYSTEM

i) Danger due to perching of bird and falling of trees. Failure may be normal operating voltage.
ii) Dilapidation of the paddingused in the electrical network, that is within the system causedvia normal breakdown voltage.
iii) Insulation collapsing due to direct stroke of lightening or consequence disturbances. This fault will not be normal voltage (Okeke, 1998).
iv) The Vegetation on Line.
v) Changing of broken collapsed wooden and reinforced concrete poles.
vi) Changing of lightening arrestor, Pot insulators and closure of J&P ’D’ fuse that was ill fitted.
vii) Faulty Underground Cable.
viii) Mending of broken up riser cable end.
ix) Construction of Substation
x) Extension of High tension over head and cable

II. METHODOLOGY

A. RESEARCH DESIGN

This paper will analyzed the methodology adopted in gathering data, and how they are analysed will be clearly explained in details. The research design was an analytical survey. Analytical surveys means diagnostic study attempt to describe and explain *why* certain situations exist. Here, various variables are normally scrutinized to assess research hypotheses. In this study, the researchers sought to establish the cost effect of using power from PHEDC and power generating on commercial businesses; to generate the frequency distribution of power across 24 months between using PHEDC and using power generating sets.

B. AREA OF THE STUDY

The territory of the examination is Garden City. Port Harcourt was established in 1912 by Frederick Lugard, legislative head of both the Northern Nigeria Protectorate and the Southern Nigeria Protectorate. Its motivation was to send out the coal that geologist Albert Ernest Kitson had found in Enugu in 1909. The pilgrim government made the general population of Diobu surrender their territory, and in 1912 the working of a port-town was begun. Different towns that were later ingested into the city included Oroworukwo, Mkpogua, and Rumuomasi. In the brooks toward the south of the first port were the angling camps and grounds of the Okrika-Ijaw group.

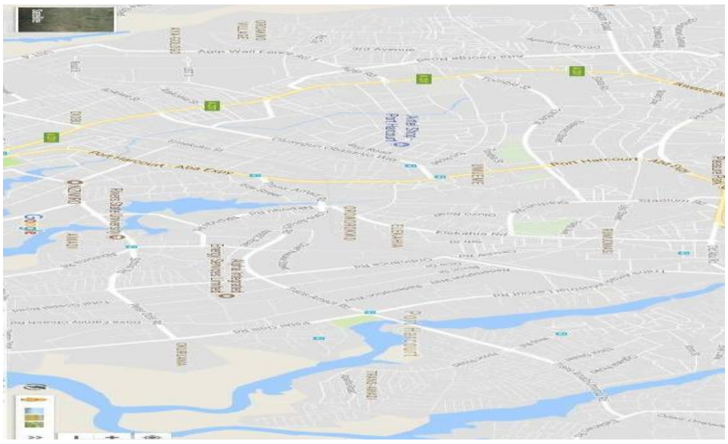

Figure 1: *Map of Garden City Central Port Harcourt*

C. UNIT OF ANALYSIS

In this study, the unit of analysis were the different power sources, their frequency of power generation and cost of running them.

D. UNIT OF OBSERVATION

The unit of observation in this study were the individual companies whose cost of power utilization from PHEDC and using generating set were aggregated to inform the cost effect it has on commercial businesses (case study firms) in the case study areas.

E. CASE STUDY

Three base stations hosting three major telecommunication network service providers were selected under the area of consideration to be used in comparing the cost of power supplied by PHEDC and the cost of powering private generating set. The data used for the cost modelling were obtained directly from the case study telecommunication companies. The data contained the cost spent on power consumption within the period of 24 months. The three base stations technical /financial information were given by the technical/commercial department.

These case studies are in Garden City and are in close proximity to one another. They share similar characteristics in terms of base power feeder source and location but different power generating sets and administrative/logistic strategies. The three base stations were selected through purposive sampling procedures. Their selection was based on their power feeder source and location of the case study base stations. Below are the Base stations sampled for the study?

Table 1: *Showing the Base Stations under Consideration and Their Location*

S/N	**Code Name**	**Location**
1	T0344	GRA phase II
2	T2076	Obaji Junction
3	T2078	Abacha Road

F. DATA COLLECTION

The data used for examining power outages were collected from the control room daily excel tracker of power availability/outage of Port Harcourt Electricity Distribution Company (PHEDC) and from the technical/commercial department of the case study telecommunication companies. The parameter used was recorded during power availability and outages by PHEDC control room operator. Also, the control room operator also gave an explanation for all data obtained that were clear.The data use for analysing power failures were collected from daily book of record of power supply and failures of PHEDC. However, five transmission centres have been selected under the study area to be used in weighting the cost of power supply from PHEDC and the cost of powering private generating set.

G. **DATA ANALYSIS**

In the study, the data was analyzed using both quantitative and qualitative analysis method using both Microsoft Excel and SPSS analysis packs. Quantitatively, frequency distribution of the data was carried out and they were presented in bar charts, box plots and histograms to show the percentage distribution. More so, Pearson Product Moment Correlation was used to determine the cost effect of running a private power generating sets during power outages of PHEDC utility power. The formula for Pearson Product Moment Correlation is given below as

$$r = \frac{n\left(\sum xy\right) - \left(\sum x\right)\left(\sum y\right)}{\sqrt{\left[n\left(\sum x^2\right) - \left(\sum x\right)^2\right]\left[n\left(\sum y^2\right) - \left(\sum y\right)^2\right]}} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Where r = Pearson correlation coefficient
N = number of pairs of respondents
$\sum xy$ = sum of the product of pair respondents
$\sum x$ = sum of x respondents
$\sum y$ = sum of y respondents
$\sum x^2$ = sum of squared x respondents
$\sum y^2$= sum of squared y respondents

Note:
If *r* is positive, hence, there is a positive correlation between the measured variables.
If *r* is negative, hence, there is a negative correlation between the measured variables.
If *r* is zero, there is no relationship between the measured variables
Below formula was used to determine the standard deviation of the cost of using PHEDC against generating set for the three year case study firms.

$$S.D = \sqrt{\frac{\sum (x-\mu)^2}{N}} \quad \ldots\ldots\ldots\ldots\ldots (2)$$

where ∑ means "sum of", x is a value in the data set, μ is the mean of the data set, and N is the number of data points in the population.

III. RESULTS AND DISCUSSION

- **RESULT**

The presentation of data, analyses and interpretation of the data collated for the study. Quantitative data such as frequencies and descriptions are presented in percentages using pie chart, bar charts, boxplots and histograms. Qualitative data were analysed using statistical packages such as Microsoft Excel and SPSS 20.0 respectively. Cost effect comparison analyses were done using Pearson Product Moment Correlation to establish the effect of power outages on the operating cost of the firms in the case study. More so, the correlation coefficient was used to compare the operating cost across the case study firms respectively.

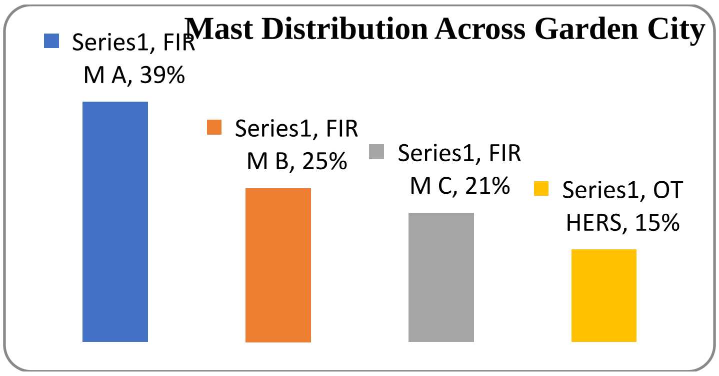

***Figure 1:** Showing GSM Mast distribution across Garden City, Port Harcourt*

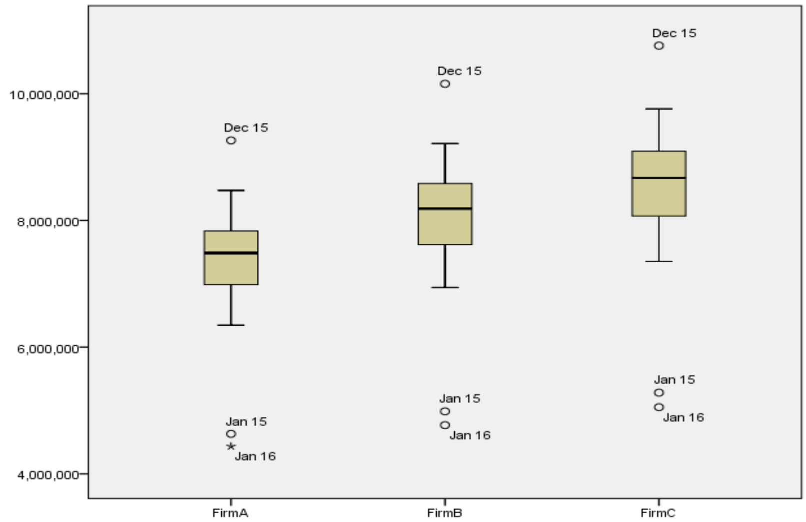

Figure 2: *Showing a boxplot measuring the cost effect of electrical power outages on electricity demands by the case study firms.*

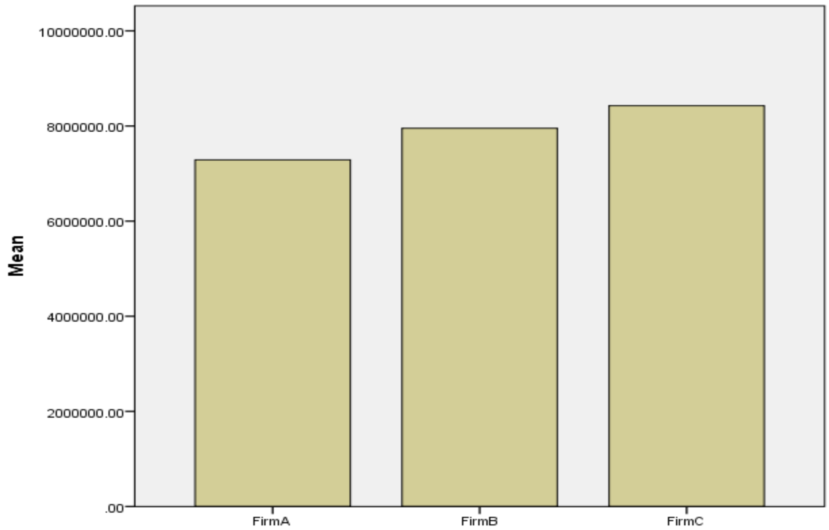

Figure 3: *Cost of Powering the diesel generator for two years across the three firms*

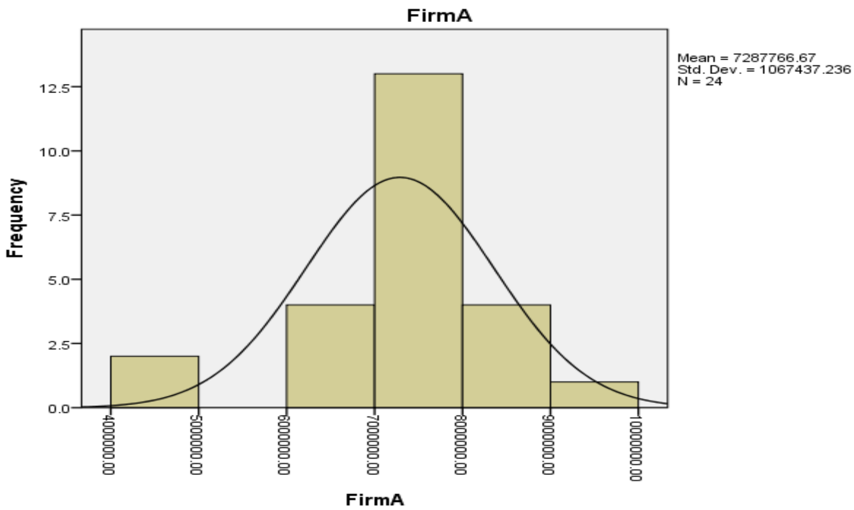

Figure 4: *Showing mean and standard deviation of power outages in firm A base stations for a two-year period*

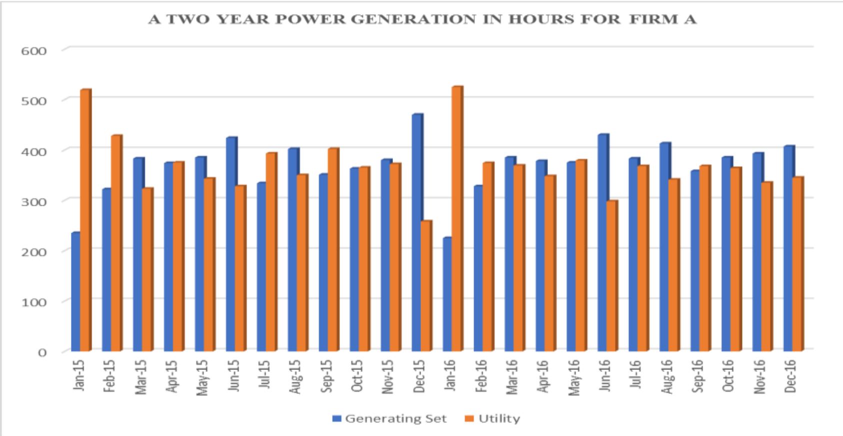

Figure 5: *Showing frequency distribution and power outages in firm A base stations for a two-year period*

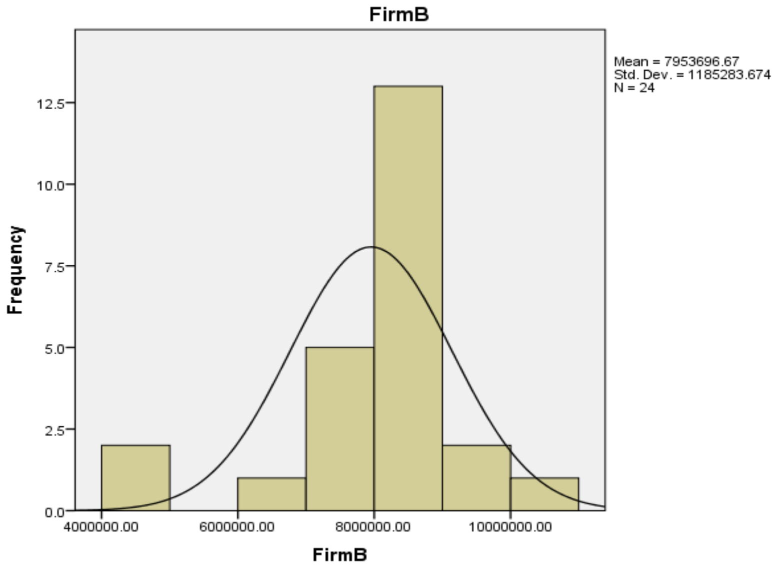

Figure 6: *Showing mean and standard deviation of power outages in firm B base stations for a two-year period*

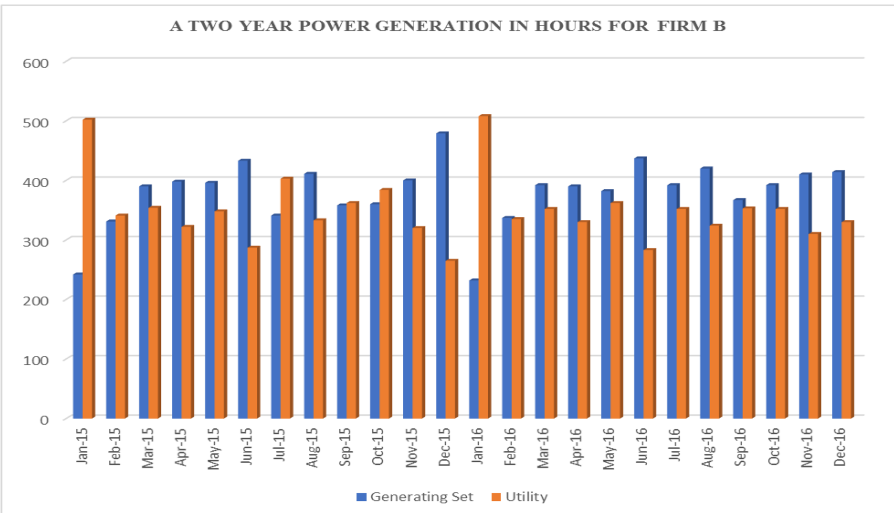

Figure 7: *Showing frequency distribution and power outages in firm B base stations for a two-year period*

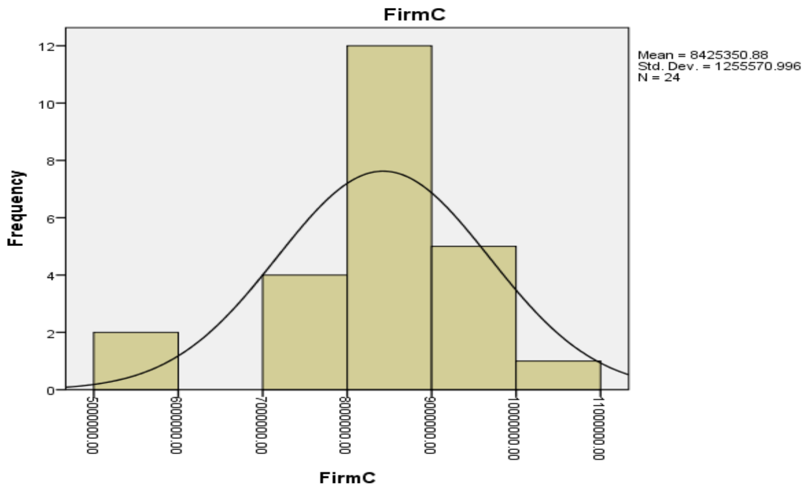

Figure 8: *Showing mean and standard deviation of power outages in firm C base stations for a two-year period*

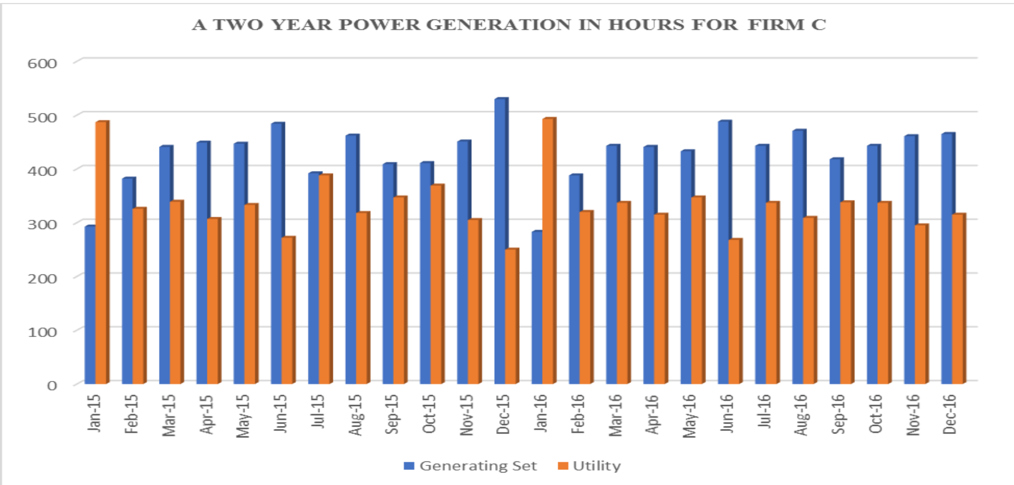

Figure 9: *Showing frequency distribution and power outages in firm C base stations for a two-year period*

Table 1: *Showing the correlation coefficient on the running cost of private generator over PHEDC*

	FIRM A		FIRM B		FIRM C	
	PHEDC Payment	Diesel Cost	PHEDC Payment	Diesel Cost	PHEDC Payment	Diesel Cost
Pearson Correlation	1	-.268	1	-.301	1	-.287

Table 2: *Showing Total Numbers of Hours of PHEDC Power Supply for January 2015 and 2016*

	January 2015 (hrs)	**January 2016 (hrs)**
Firm A	**519**	**525**
Firm B	**502**	**508**
Firm C	**487**	**493**

- **ANALYSIS OF DATA**

Figure 1 showing the distribution of case study firms GSM mast across Garden City, Port Harcourt. Firm A had a GSM mast coverage of 39% across the Garden City, Firm B had 25% of mast coverage within the same area as firm A, and firm C had a 21% GSM mast coverage while other telecommunication firms shared the remaining 15% of GSM mast coverage in the Garden City.

i. Analysis of the cost effect of electrical power outages on electricity demands by commercial consumers within Garden City Central Area of Port Harcourt Rivers State. In figure 2, firm C is highly affected by the electrical power outages which resulted in the high demand for an alternative power supply to their base stations which was a generating set. The amount of diesel used by firm C to power their base stations for the 24 months averaged was more than used by firm B and firm A respectively. As observed in figure 2, a mean value of 8425350 for power outages was observed in a two-year period. More so, firm a recorded a mean value of 7287766 while firm C recorded a mean value of 7953696 for power outages in their base stations within the two-period observed in the study respectively.

ii. Frequency distribution and obtain the standard deviation of power outages for the period of 2 years. Figure 4 showed that the mean and standard deviation of the power outages for firm A was 7287766.67 and 1067437.236 respectively. From the figure above, the distribution is said to be a normal distribution as a symmetrical shape is observed from the histogram. However, in figure 4, the power outages in firm A base stations were minimum in January of 2015 and 2016. These trend is also observed for other base stations operated by other firms sampled in this study. Thus, the operating cost for firm A in the month of January was the least compared to other months of the year within the two-year period observed in this study.

Figure 6 portrayed the mean and standard deviation of power outages in firm B base stations for a two-year period. It was observed that 7953696.67 was obtained as the mean while 1185283.674 was obtained as the standard deviation for the power outages in this base station. Also, firm B enjoyed near constant power supply to the base station from PHEDC in the month of January 2015 and January 2016. However, in figure 6, firm B base stations experienced high prevalence of power outages in December 2015 when compared to other months within the two-year period of the study. Hence, December 2015 seemed to be the month of highest operating cost for firm B.

Figure 8 presented the mean and standard deviation for power outages in firm C base stations. A mean value of 8425350.88 was observed while 1255570.996 was gotten for the standard deviation for the power outages respectively. In figure 8, firm C used private generating set for alternative power supply to their base stations than any other firm in the study as indicated in their mean value of 8425350.88 which was higher than the mean value of other firms in the study. Firm C also enjoyed near constant power supply from PHEDC in the months of January 2015 and 2016 respectively.

iii. Comparing The Running Cost of Private Generator Over Phedc Using Pearson Product Moment Correlation (PPMC) Factor. In table 1 above, the running cost correlation coefficient of private generator over PHEDC was all negative for the three case study firms which confirms that the effect of power outages in these base stations affects and increases the operating cost for the case study base stations. From table 1 above, firm B incurred the highest operating cost with a correlation coefficient of -0.301, followed by firm C with a correlation coefficient of -0.287 and then firm A which a correlation coefficient of -0.268 respectively.

Although, Firm C had the highest number of hours operating using private generator with an average private generator running hours of 414.08 but she however had a lesser operating cost than firm B which had an average private generator running hours of 365.12 but incurred more operating cost than firm C. This difference in operating cost between both firms was due to the rate at which firm C sourced for diesel to power their private generator which was less than that of the firm B. As shown in appendix D, firm C sourced for diesel at N198/litre while firm B got theirs at N200/litre. Hence the difference in their operating cost.

- **DISCUSSION OF FINDINGS**

i. To examine the cost effect of electrical power outages on electricity demands by commercial consumers within Garden City Central Area of Port Harcourt Rivers State.

Findings of the study showed that the electrical power outages had a negative cost effect on the case study firms.These power outages prompted these firms to seek an alternative source of power as backup to ensure the smooth operating of their businesses. However, the effort to seek for these alternative power supply led to incurring extra operating cost for the firm. This finding agrees with Adegoke and Babalola (2011) that, 78% of the total cost of operations by GSM operators goes into provision of generators and its fuelling. The direct consequence of this is a drastically increase in the call tariff. The researchers added that, it is obvious that the cost of procurement and fuelling is so enormous. If our power supply system is stable, this huge amount could have been used in upgrading and optimizing existing base stations in order to improve service efficiency.

More so, the over dependency of power generation on diesel engines is as a result of frequent power outages in these base stations which has a significant negative effect on the base station equipment. This has led to an alternative and near steady power supply to these base stations to support the daily business activities of these firms.

During fuel scarcity, an increase in the prices of diesel products which are used as fuels to power the base stations upon PHEDC power outage will affect the operating cost of the firms. However, these increase in prices of diesel will drive up and the operating cost and reduce the profit of the firm.

In summary, if PHEDC could provide a near constant power supply to their base stations, it would reduce the firm’s operating cost which will in turn reduce call and data tariffs of their subscribers.

ii. To compare the running cost of private generator over PHEDC using Pearson Product Moment Correlation (PPMC) factor.

As observed in the study, it is cheaper for the firm to power their base stations using power supply from PHEDC when compared to powering the base stations using private generating set. Since the nature of these firm's businesses require constant power supply to it base stations, power outages from PHEDC becomes a problem to their businesses. Powering their base stations using privately owned generating sets incurs more expenses and these expenses are being shared to the subscribers through their call and data tariffs respectively. Thus, the end consumers end up paying for the cost effect of the power outages incurred by these firms.

More so, the researcher observed that case study resort to powering their base stations with diesel generators because they are easily procured and delivered to their base stations upon power outages. With the increase in the number of mobile telecommunication subscribers in the state, the issue of competition has forced case study firms to find ways to stay in business even incurring high operating cost so as to provide their subscribers with the needed services and thereby making the subscribers pay extra charges for the extra expenses they incur while running private generating sets in their base stations for constant service.

As indicated in the study, all the firms recorded their least operating expenses on power generation in the months of January 2015 and January 2016 respectively. Studies showed that all the firms enjoyed a near constant power supply from PHEDC in those months. The table below shows the total number of hours of PHEDC power supply for January 2015 and 2016 for the three case study firms.

In summary, as duly observed from the study, if PHEDC could provide regular power supply to these base stations, the case study firms would have recorded less operating cost and more profits on their investments.

IV. CONCLUSIONS

The analysis shown in Appendix (C, D and E) one can draw a conclusion that most telecommunication firms in Nigeria have adopted strategies to cope with this poor electricity supply. Some of these response adjustments include: choice of solar panel to power the base stations, choice of small gas turbines, output reduction, factor substitution and self generation. While all these strategies are observable amongst telecommunication firms, the most commonly adopted strategy by telecommunication industry is investment in alternative generation(i.e. complementary capital). Mostend users of power both household and firms now generate power to make up for the inadequate provision resulted from the inadequacy of the public power system. The result from the studyposits that the rate of unsupplied kilowatt of electricity is notably higher than the cost of power from the public grid using a Pearson Product Moment Correlation (PPMC) factor by over 40%, of the cost on running on PHEDC, with a standard deviation of 1067437.236 for firm A,1185283.674 firm B and 1255570.996 for firm C,which approximately entails that thereis high possibility of experiencing repeatable power outages, within the area under study. This can be obviously true that the time interval midpoints are relatively low compared to the others and also from the uneven frequencies distributions of the power outages.

V. RECOMMENDATIONS

The following recommendations were made for the study;

i. Port Harcourt Electricity Distribution Company of Nigeria should conduct a forecast of power demand trend within Port Harcourt and across the whole Nigeria. This will enhance the determination of the demand growth rate, so as to enable them carryout equipments and facility upgrades which will match the power supply to power demand with time.

ii. The government should embark on enormous capital investment across the electrical power chain (Generation, Transmission, Distribution and Sales) is required so as to encourage the Port Harcourt Electricity Distribution Company of Nigeria in meeting up with the society power supply demands.

iii. Improvement in generation capacity.

iv. Deliberate and sustained distribution network reinforcement/upgrade.

v. Enforcement of legislation against acts of vandalism on PHEDC Installations.

vi. Mutual understanding between the power Supply Company and customers.

vii. Prompt payment of electricity bills.

viii. Comprehensive metering of customers.

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APPENDIX A

Correlations

Firm A

Descriptive Statistics

	Mean	Std. Deviation	N
PHEDC Payment	4941469.2500	1207942.88614	24
Diesel Cost	7287766.6667	1067437.23598	24

Correlations

		PHEDC Payment	Diesel Cost
PHEDC Payment	Pearson Correlation	1	-.268
	Sig. (2-tailed)		.206
	N	24	24
Diesel Cost	Pearson Correlation	-.268	1
	Sig. (2-tailed)	.206	
	N	24	24

Firm B

Descriptive Statistics

	Mean	Std. Deviation	N
PHEDC Payment	4387914.9038	1446000.16173	24
Diesel Cost	7953696.6667	1185283.67404	24

Correlations			
		PHEDC Payment	Diesel Cost
PHEDC Payment	Pearson Correlation	1	-.301
	Sig. (2-tailed)		.153
	N	24	24
Diesel Cost	Pearson Correlation	-.301	1
	Sig. (2-tailed)	.153	
	N	24	24

Firm C

Descriptive Statistics			
	Mean	Std. Deviation	N
PHEDC Payment	4243249.3925	1430047.10343	24
Diesel Cost	8425350.8792	1255570.99624	24

Correlations			
		PHEDC Payment	Diesel Cost
PHEDC Payment	Pearson Correlation	1	-.287
	Sig. (2-tailed)		.173
	N	24	24
Diesel Cost	Pearson Correlation	-.287	1
	Sig. (2-tailed)	.173	
	N	24	24

APPENDIX B

A Two-Year Power Generation from both PHEDC and Private Generator in Firm A

S/N	Month	Gen run, hr	Utility, hr	Gen % utilization,	Utility % Utilization	Diesel Consumed	PHEDC Utility Payment (Excl tax)	Cost of Diesel@ 200/Litre
1	Jan-15	235	519	31	69	23,158	5,037,660.0	4,631,600
2	Feb-15	322	428	43	57	31,731	7,727,947.0	6,346,200
3	Mar-15	383	323	54	46	37,412	7,197,667.0	7,482,400
4	Apr-15	374	375	50	50	36,855	5,302,800.0	7,371,000
5	May-15	385	343	53	47	37,939	5,833,080.0	7,587,800
6	Jun-15	424	328	57	43	41,782	4,860,800.0	8,356,400
7	Jul-15	334	393	46	54	32,913	6,186,600.0	6,582,600
8	Aug-15	402	350	54	46	39,614	5,656,320.0	7,922,800
9	Sep-15	351	402	46.5	53.5	34,589	6,009,840.0	6,917,800
10	Oct-15	363	365	50	50	35,771	6,363,360.0	7,154,200
11	Nov-15	380	372	50.4	49.6	37,446	5,656,320.0	7,489,200
12	Dec-15	470	258	65	35	46,315	4,772,520.0	9,263,000
13	Jan-16	225	525	30	70	22,172	5,126,040.0	4,434,400
14	Feb-16	328	374	47	53	32,322	4,419,000.0	6,464,400
15	Mar-16	385	369	51	49	37,939	4,242,240.0	7,489,200
16	Apr-16	378	348	52	48	37,249	4,330,620.0	7,449,800
17	May-16	375	379	50	50	36,954	4,153,860.0	7,390,800
18	Jun-16	430	298	59	41	42,373	3,711,960.0	8,474,600
19	Jul-16	383	368	51	49	37,742	3,888,720.0	7,548,400
20	Aug-16	413	341	55	45	40,698	4,419,000.0	8,139,600
21	Sep-16	358	368	49	51	35,278	3,535,200.0	7,055,600
22	Oct-16	385	364	51	49	37,939	3,358,448.0	7,587,800

23	Nov-16	393	335	54	46	38,727	3,181,680.0	7,745,400
24	Dec-16	407	345	54	46	40,107	3,623,580.0	8,021,400

APPENDIX C
A Two-Year Power Generation from both PHEDC and Private Generator in Firm B

S/N	Month	Gen run, hr	Utility, hr	Gen % utilization,	Utility % Utilization	Diesel Consumed	PHEDC Utility Payment (Excl tax)	Cost of Diesel@ 200/Litre
1	Jan-15	242	502	32.52688172	67.47311828	24931.5	4,747,415.95	4986300
2	Feb-15	331	341	49.25595238	50.74404762	34708.3	7,475,587.47	6941660
3	Mar-15	390	354	52.41935484	47.58064516	41154.3	7,418,243.66	8230860
4	Apr-15	398	322	55.27777778	44.72222222	40605.4	5,124,939.97	8121080
5	May-15	396	348	53.22580645	46.77419355	41375.4	4,268,130.95	8275080
6	Jun-15	433	287	60.13888889	39.86111111	45852.4	4,625,042.44	9170480
7	Jul-15	341	403	45.83333333	54.16666667	35824.8	6,421,079.39	7164960
8	Aug-15	411	333	55.24193548	44.75806452	43573.2	5,071,427.84	8714640
9	Sep-15	358	362	49.72222222	50.27777778	37703.6	5,684,979.64	7540720
10	Oct-15	360	384	48.38709677	51.61290323	39197.4	6,440,262	7839480
11	Nov-15	400	320	55.55555556	44.44444444	40709.9	4,775,696.70	8141980
12	Dec-15	479	265	64.38172043	35.61827957	50782.6	3,860,241.61	10156520
13	Jan-16	232	508	31.35135135	68.64864865	23846.9	4,804,157.95	4769380
14	Feb-16	337	335	50.14880952	49.85119048	35228.6	2,930,716.12	7045720
15	Mar-16	392	352	52.68817204	47.31182796	41190.6	3,328,864	8238120
16	Apr-16	390	330	54.16666667	45.83333333	40648.3	3,120,810	8129660
17	May-16	382	362	51.34408602	48.65591398	40106	3,423,434	8021200
18	Jun-16	437	283	60.69444444	39.30555556	46068	2,676,331	9213600
19	Jul-16	392	352	52.68817204	47.31182796	41190.6	3,328,864	8238120
20	Aug-16	420	324	56.4516129	43.5483871	44225.5	3,064,068	8845100
21	Sep-16	367	353	50.97222222	49.02777778	38480.2	3,338,321	7696040
22	Oct-16	392	352	52.68817204	47.31182796	41190.6	3,328,864	8238120
23	Nov-16	410	310	56.94444444	43.05555556	42274.1	2,931,670	8454820
24	Dec-16	414	330	55.64516129	44.35483871	43575.4	3,120,810	8715080

APPENDIX D
A Two-Year Power Generation from both PHEDC and Private Generator in Firm C

S/N	Month	Gen run, hr	Utility, hr	Gen % utilization,	Utility % Utilization	Diesel Consumed	PHEDC Utility Payment (Excl tax)	Cost of Diesel@ 198/Litre
1	Jan-15	293	487	37.56410256	62.43589744	26676.705	4,605,560.90	5281987.59
2	Feb-15	382	326	53.95480226	46.04519774	37137.881	7,146,749.31	7353300.438
3	Mar-15	441	339	56.53846154	43.46153846	44035.101	7,103,911.30	8718949.998
4	Apr-15	449	307	59.39153439	40.60846561	43447.778	4,886,200.53	8602660.044
5	May-15	447	333	57.30769231	42.69230769	44271.678	4,084,159.79	8765792.244
6	Jun-15	484	272	64.02116402	35.97883598	49062.068	4,383,315.48	9714289.464
7	Jul-15	392	388	50.25641026	49.74358974	38332.536	6,182,081.40	7589842.128
8	Aug-15	462	318	59.23076923	40.76923077	46623.324	5,909,051.06	9231418.152

9	Sep-15	409	347	54.1005291	45.8994709	40342.852	5,449,414.18	7987884.696
10	Oct-15	411	369	52.69230769	47.30769231	41941.218	6,188,689.27	8304361.164
11	Nov-15	451	305	59.65608466	40.34391534	43559.593	4,551,835.91	8624799.414
12	Dec-15	530	250	67.94871795	32.05128205	54337.382	3,641,737.36	10758801.64
13	Jan-16	283	493	36.46907216	63.53092784	25516.183	4,662,302.90	5052204.234
14	Feb-16	388	320	54.80225989	45.19774011	37694.602	2,799,490.03	7463531.196
15	Mar-16	443	337	56.79487179	43.20512821	44073.942	3,187,009	8726640.516
16	Apr-16	441	315	58.33333333	41.66666667	43493.681	2,978,955	8611748.838
17	May-16	433	347	55.51282051	44.48717949	42913.42	3,281,579	8496857.16
18	Jun-16	488	268	64.55026455	35.44973545	49292.76	2,534,476	9759966.48
19	Jul-16	443	337	56.79487179	43.20512821	44073.942	3,187,009	8726640.516
20	Aug-16	471	309	60.38461538	39.61538462	47321.285	2,922,213	9369614.43
21	Sep-16	418	338	55.29100529	44.70899471	41173.814	3,196,466	8152415.172
22	Oct-16	443	337	56.79487179	43.20512821	44073.942	3,187,009	8726640.516
23	Nov-16	461	295	60.97883598	39.02116402	45233.287	2,789,815	8956190.826
24	Dec-16	465	315	59.61538462	40.38461538	46625.678	2,978,955	9231884.244

Ijeoma R.C. “The Effect of Power Failures on Commercial Consumer within Port Harcourt Garden City, Rivers State.” IOSR Journal of Engineering (IOSRJEN), vol. 09, no. 08, 2019, pp. 13-26.