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Prepaid Metering Empowerment for Reliable Billing and Energy Management of Electricity Consumers in Nigeria

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Authors' contributions

This work was carried out in collaboration between both authors. Author OOF designed the study, wrote the protocol and wrote the final draft of the manuscript. Author OJFJ managed the analyses of the study and the literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

The complaints from the consumers of electricity on the unreliability of supplies from the distribution company along its distribution network in Nigeria, as well as high estimated bills for the energy used with estimated billing; with the management of the available supplies to take care of needs of consumers with limited resources with consumers acceptability of cost to benefit ratio is discussed. The work takes a deliberate look at the electricity consumers consumption pattern with the use of estimated bills and pre-paid meters in one of the major estates in Ekiti State, Nigeria; with the spearman's rank order correlation used to validate that pre-paid metering of consumers electricity consumption gives a better need based energy management, in which case, with the use of prepaid metering system, there is a reduced case of lost income, and waste in comparison to the present demand based management system.

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1. INTRODUCTION

Nigeria Power sector was managed by the Federal Government of Nigeria (FGN) until the choice of privatization in 2013 to be handle by three independent divisions such as 1 Transmission company, 6 Generation Companies and 11 Distribution Companies. FGN now takes charge of the Transmission while the other two segments are managed by private investors. The Generation Companies (GENCos) though invisible to the consumers have generated between 2300MW and 4500MW of electricity each day since the period of its takeover. The Distribution Companies (DISCos) such as Benin Electricity Distribution Company (BEDC) is the front end and the sector that receives blame of shortage of electricity from the consumers. Nigeria as a Nation has a population of about 160 million with the following statistical data: 36 states plus FCT, 774 Local Governments, 32 million Households, with electricity consumers of 4 million, an ideal power of 160,000MW required, and only 12.5% of her population has access to power. Ekiti state is serviced by BEDC with the following statistics: 4 states involving Edo, Delta, Ondo and Ekiti, 77 Local Governments with 1500 rural communities, Households of 4.6 million, population of 13.2 million, electricity consumers 741,376, access to power is 16.1%, ideal power requirement is 13,000MW.Out of the total available power in Nigeria, only 9% is allocated to BEDC [1,2].

GENCos obtain funds by selling what they generate to DISCOs, since DISCOs are unable to realize all money for the energy sold to consumers, loss are incur through power theft, Hence GENCos are under performing in generation. DISCos incur loss through three basic are: huge unpaid bills by the consumers (Collection loss), power leakages due to poor aged and insufficient generation, transmission and distribution network and power infrastructure (technical loss), illegal consumption of power by consumer who are customers of DISCos and bypass of meters by consumer to reduce their power paid for (Commercial loss). The Aggregate technical, commercial and collection losses (ATC&C) in Nigeria is about 50% as a result high level of poor payment culture and this invariably leads to low power availability to the end users. An attempt by the NERC to assist DISCos ensuring proper billing of energy used by consumers based on the actual readings is the introduction of an assisted metering scheme [1,2,3].

2. ELECTRICITY BILLING SYSTEM IN NIGERIA

The DISCos use a monthly billing system in which the unit that is consumed in a previous month is paid in the succeeding month. In a typical bill, there are eight columns which contain: Descriptions, tariff code, read date, present reading, previous reading, multiplier, consumption and current charges. Under the descriptions columns there are always two rows which are energy charges and fixed charges. There is a number in the consumption column which is calculated by subtracting previous reading from the present reading. However, sometimes you can see a number with "E" by the side under the consumption column like 150E. This means that the consumption figure is not gotten from the meter reading but an estimate figure. The current charges is obtained by multiplying the consumption figure with the energy multiplier charge which is dependent on the classification of the premises (i.e. R1, R2, R2SP, R2TP, C1SP) etc.

For the electricity billing, Current charge = (consumption x energy multiplier charge) plus fixed charge plus VAT in Nigeria, where the fixed charge always include the meter maintenance charge, and in R2SP premises, fixed charge is #750.00 [4,5].

One of the great challenges faced by power supply in Nigeria from inception and was aggravated since handover from PHCN to private owners in 2013 is the controversy between the DISCos and electricity consumers over the appropriate billing system. There is arbitrary and lack of transparency in the method used by energy provider to cost and assess the customer energy consumption. Such dark practices manifest through estimated billing systems and irregularity in metering. It is noted that the bill for any current month is prepared when the period has not ended, sometimes, in discriminatory charging due to loss of revenues incurred by DISCos [4,6].

There are three basic ways of charging electricity customers for the consumption of energy: Post

paid metering system, Estimated billing system and Prepaid billing system.

2.1 Electricity Post-paid and Estimated Billing Systems in Nigeria

Post-paid involves the payment of electricity bills after consumption by the customers; this has led to drastic increase in non-payment of bills by customers of the PHCN. While Estimated billing system is said to be analogous to fraud where consumers are mandated to pay far above what they consumed monthly. Most of the customers under this system are without meters and the residences are never visited to track the energy utilization over the period charged. Provision of meters to individual client may not totally eradicate this menace, however it is a good step forward to the means. About 6 million electricity consumers in Nigeria were noted to have no meters to monitor their electricity consumption monthly. This encourages estimated and fixed charges allocated to the consumers but this results in defrauding acts by the consumers not paying anything out of the over blotted bills, the Disco incur great debt as a result, unable to pay the energy bought from the GENCOs and invariably lack of enough power generation. The low power generated in Nigeria is being wasted by customers assisted by the default or the estimated/ post paid billing systems adopted by DISCOs, they encourage power wastage and lead to breakdown of power distribution and transmission equipment [5]. These systems are known to be exploitative and destructive hence should be outlawed and replaced by prepaid. Estimated billing system affords opportunity for over pricing of energy consumption to the detriment of consumers. The DISCOs charge the utility by direct billings for the unmetered that are on direct connection, and post paid for people with meters using estimated billing system. The effects of estimated billing on consumers energy use is as shown in Fig. 1.

2.1.1 Disadvantages of postpaid/ estimated billing systems

- over billing of customers
- absence of service orientation to the customers
- Collection of illegal money from the customers by the Discos officials
- Illegal collection and stealing of power supply by the consumers
- Inadequate power supply and metering system

2.2 Electricity Pre-Paid Metering System in Nigeria

Prepayment method involves consumers to possess a credit in their electricity account before the usage of the service, when such credit is depleted, supply is remotely disconnected. Electricity prepaid billing system was first used in SA in mi 1980s with the motives of providing electricity to the low income earners of the community at affordable rates [7,8]. PHCN faced a daunting consumer debt profile as well as revenue collection difficulties, led to the introduction of pre-paid system in 2016 [7]. This step was believed to boost revenue collection. The act of making advance payment to energy service is gradually taken over, it is a new way and growing trend of charging electricity consumers in the developed world like US. Prepaid services connotes that the customers pay for electricity in advance while their meters track the spending as a result of energy consumption and give the amount of energy remain in their account [9,10].

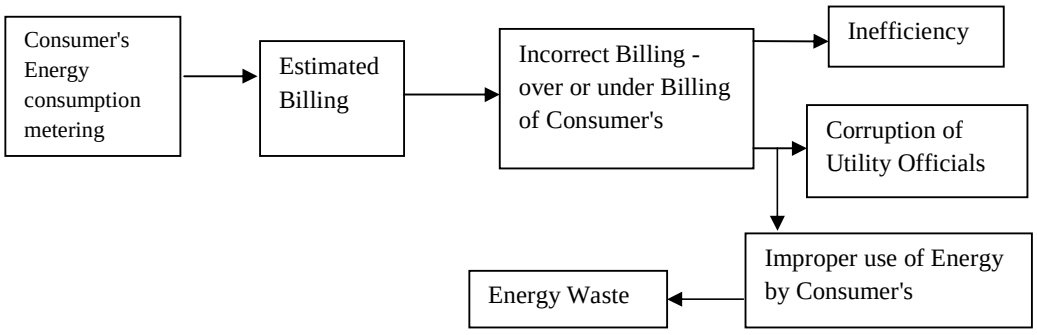

Fig. 1. Flow diagram of effects of estimated billing on consumers energy use

2.3 Merits of Prepaid over Postpaid/ Estimated Billing Systems

Disengaging estimated billing system with replacement by prepaid will afford the certainty that consumers are paying for the actual energy consumed. The preference of this are numerous and some according to [7,11,12,13] are listed below:

- There is ease of revenue collection while the consumers acquire knowledge of their energy consumption and gain control of their usage to manage their budget appropriately.
- Prepaid metering system reduces the level of contact between the energy provider officials and consumers, as well as illegal connection to the grid perpetrated by some criminal as common in the post paid system since the officials won't be available n site every time to check mate the sabotages.
- There is immediate restoration of electricity to the prepaid customers upon the purchase of token, this in contradiction to the experience with customers with post paid, days and weeks may elapse before help comes to them for reconnection when need arises.
- Prepaid meter places caution on energy consumption of the consumers its installation afford the provider ease of debt collection.
- Advance meter provides information to customers about the energy cost and consumption level, enabling access to real-time energy consumption on daily/monthly basis, this will help users in their budget.
- Prepaid service creates opportunity of control of when and how much is paid for energy and effective usage.

2.3.1 Benefits of prepaid to energy provider

The pitiable financial state of DISCos that has led to their underperformance as claimed is heightened by seemingly negative attitudes of numerous electricity consumers in Nigeria towards prompt payment for the energy consumed while some don't even deem it fit to pay at all. It is hard to believe that Government parastatals are the worst culprit of this criminal offence, their debt profile had risen to the highest in electricity firms to the tune of 45 billion naira as reported by DISCos [14,15], this could have been avoided if prepaid metering system are in place in all these sectors. The following are some of the benefits of prepaid metering systems to the energy providers:

- It improves cash flow
- Reduces cost associated with billing, notification of disconnection, disconnection, and reconnection, customer service staff and call centers.
- Reduces bad debt and write-offs because arrearages don't build up
- Improves detection and management of outages.
- Metering and most importantly, prepaid system will enable the DISCOs to determine their revenues.
- Disengaging estimated billing system with replacement by prepaid will afford the certainty that consumers are paying for the actual energy consumed

The only way to encourage and sustain positive attitude towards regular payment of electricity bills is through advance payment of electricity consumption and will result in improvement and sustainable power sully for the benefit of all and sundry in the Nation [14,16].

3. METHODOLOGY

The paper focuses on the highlight of advantages of Need Based Energy Management (NBEM) to reduce the problem of lost income, and unnecessary waste of limited supplies, with the sampled data for submission obtained from questionnaires and personal interviews of energy consumers. The study was carried out in State Housing Estate of Oke-ila, Ado Ekiti, the capital city of Ekiti State in Nigeria. The choice of the estate was based on the vast use of both estimated bills and pre-paid meters, with consumers of high literacy level, to respond to needed information required without fear. A total of 168 questionnaires were administered with 146 responses, while other works were from published literatures.

Spearman's correlations were used to determine the correlations between the estimated bills in relation to the calculated bills, as well as prepaid bills for the sampled consumers. Spearman's rank order correlation (or spearman's correlation) is a non parametric measure of the strength and direction of association that exist between two variables measured on at least an ordinal scale,

denoted by ρ. The test is used for either ordinal variables or for continuous data that has failed the assumptions necessary for conducting the Pearson's product moment correlation [17,18]. The ordinal variables must show the ranking of either strong agreement with each other, to a scale of strong disagreement, or whether there is a monotonic relationship between two variable to show whether the variables increases in value together, or as one variable increases, the other variable decreases. This relationship can be verified by using SPSS statistics, where a plot of one variable against the other, and then visually inspect the scatter-plot to check for monotony [18].

A spearman's correlation of 1 results when two variable being compared are monotonically related, even if their relationship is not linear. Thus a spearman's correlation between two variables will be high when observations have a similar (or identical for a correlation of 1) rank between the two variables, and low when observations have a dissimilar (or fully opposed for a correlation of -1) between the two variables [13,15].

The spearman's correlation coefficient is defined as the Pearson correlation coefficient between the ranked variables. For a sample of size n, the n raw data X_i, Y_i, are converted to ranks rg X_i, rg Y_i, and r_s is computed from [17,18]:

$$r_s = \rho_{rg\,x,}\, rg_y = \mathrm{cov}(r_{gx} rg_y)/\sigma_{rgx}\sigma_{rgy} \quad (1)$$

where ρ denotes the usual Pearson correlation coefficient but applied to the variable.

$\mathrm{Cov}(rg_x rg_y)$ is the covariance of the rank variables.

σ_{rgx} and σ_{rgy} are the standard deviations of the rank variables.

Only if all ranks a distinct integers, it can be computed using the popular formula

$$r_s = 1 - (6\sum d^2 i/n(n^2 - 1)) \quad (2)$$

where $d_i = r_g(x_i) - r_g(y_i)$ is the difference between the two ranks of each observation,

and n = is the number of observations.

Identical values are usually each assigned fractional ranks equal to the average of their positions in the ascending order of the value, which is equivalent to averaging over all possible permutations. If ties are present in the data set, this equation yield incorrect results. Only if in both variables all ranks are distinct, then [18,19].

$$\sigma rg_x \sigma rg_y = \mathrm{varrg}_x = \mathrm{varrg}_y = n(n^2 - 1)/6 \quad (3)$$

The standard error of the co-efficient (σ) was determined by Pearson and gusset as

$$\sigma_{rs} = 0.6325/\sqrt{(n - 1)}$$

The statistical response using Tables 1 to 4 from the questioners are as shown in Fig. 2. Out of the 168 residents of the estate served with the questionnaires on the determination of their vast use of both estimate and prepaid billing, 146 representing 86.9% returned a completely filled form used in the data gathering, out of which 98 or 67.1% were male residents and 48 representing 32.9% were female residents. From the age distribution analysis of the respondents as in Table 2, it shows that most of the respondents were between the working age with 57.5% response and the retirees with a response of 42.5% of the total. The level of educational attainment of the respondents shows that 8.2% had primary School leaving certificate, 15.1% were holders of Secondary School leaving certificate, with post-secondary and technical certificate holders making a percentage of 32.9%, while about 43.8% were 1st degree holders and above. This response analysis shows that over 75% of the residents were well learned, and understood the need to be truthful and frank in their answers to the questions raise to determine their energy use, in comparison with the billings from the utility company serving them.

Table 1. Questionnaires' responses details

	Questionnaires details	Number	Percentage (%)
i.	Returned for data gathering	146	86.9
ii.	Unreturned questionnaires	22	13.1
	Total	168	100

Table 2. Questionnaires' responses details by gender

	Sex	No. of response	Percentage (%)
i.	Male	98	67.1
ii	Female	48	32.9
	Total	146	100

Table 3. Questionnaires' responses details by age distribution

	Age bracket	No. of response	Percentage (%)
i	0 -25 yrs	0	0
ii	25 – 50 yrs	84	57.5
iii	50 yrs and above	62	42.5
	Total	146	100

Table 4. Questionnaires' responses details by educational background

	Level	No. of response	Percentage (%)
i	Primary	12	8.2
ii	Secondary	22	15.1
iii	Post- Secondary	48	32.9
iv	1st degree and above	64	43.8
Total		146	100

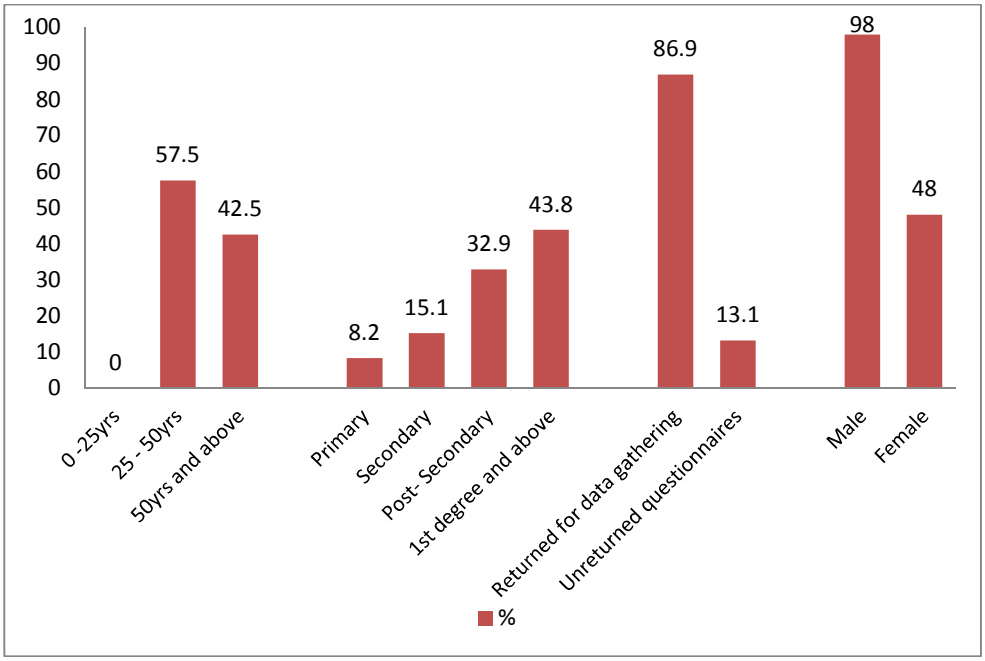

Fig. 2. The graphs of different responses from the questioners

4. RESULTS AND DISCUSSION

Table 5 shows the records of the average monthly estimated bills of consumers from the response gathered, with the average number of hours of electricity supply and consumption daily, as well as their average load consumption. The expected bill was calculated using the Benin Electricity Distribution Company's billing profile at 14.60 Naira per 1kWhr of electricity used. Also, from Table 5, the variance differentials in percentages from the calculated expected bills ranges from -29% and +48%, in which the negative value implies

an underpayments to the utility company, and the positive value giving an over-charged clients. Of course, the number of the overcharged consumers is much more than the undercharged. For the prepaid consumers, the monthly prepaid meter consumption on the energy consumed is compared with the calculated bill expected, and the variance differentials is less than 3.7% which is largely due to some underground levies, and payments of uncompleted bills before the prepaid meter installation.

Table 5. Average monthly estimated versus expected bills of energy consumption

s/n	Average number of hours consumed daily (Hr)	Average load consumed (W)	Monthly estimate bill supplied (₦)	Calculated bill expected (₦)	Variance (₦)	Variance differential (%)
i.	2	97	2297.67	1786.74	510.93	28.59
ii.	1	89	1250.45	1318.98	-68.53	-5.20
iii.	4	68	1492.32	1007.76	484.56	48.08
iv.	1	75	1347.26	1111.50	235.76	21.21
v.	1	77	1235.85	1141.14	94.71	8.30
vi.	1	92	1656.62	1363.44	293.18	21.50
vii.	2	112	1577.51	1808.04	-230.53	-12.75
viii.	3	125	2397.26	1852.5	544.76	29.41
ix.	2	83	1020.71	1230.06	-209.35	-17.02
x.	1.5	96	1145.58	1422.72	-277.14	-19.48
xi.	2	113	2250.83	1674.66	576.17	34.40
xii.	1	87	1445.57	1189.34	256.23	21.54
xiii.	3	134	2455.11	1985.88	469.23	23.63
xiv.	1.5	88	1045.24	1304.16	-258.92	-19.85
xv.	1	90	1567.53	1333.8	233.73	17.52
xvi.	2	86	1745.47	1274.52	470.95	36.95
xvii.	3	121	2412.52	1793.22	619.30	34.53
xviii.	1.5	76	850.83	1126.32	-275.49	-24.46
xix.	2	107	1112.67	1585.74	-473.07	-29.83
xx.	2	74	1457.89	1096.68	361.21	32.94

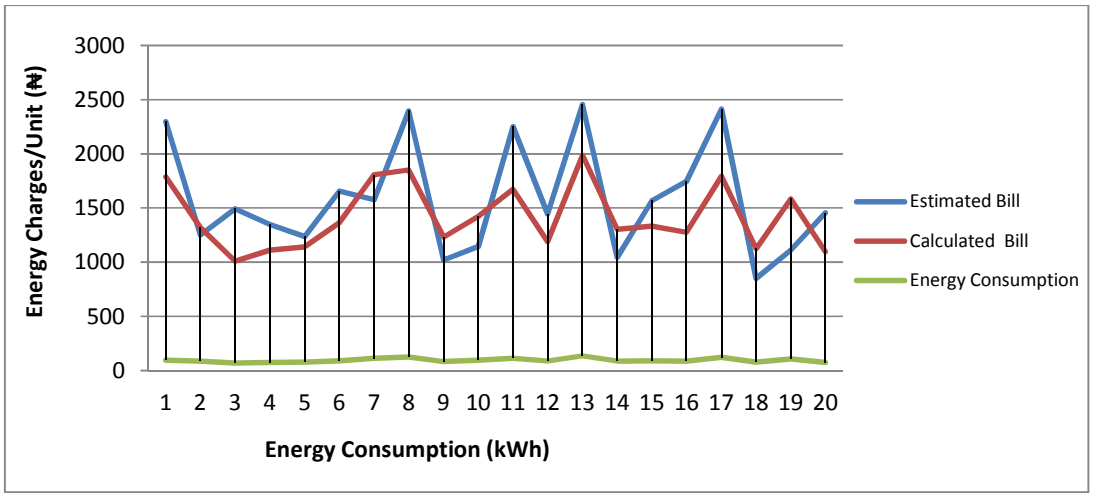

Fig. 3. Comparison of estimated and calculated energy consumption billing systems

Table 6. Average monthly prepaid versus expected bills of energy consumption

s/n	Average number of hours consumed daily (Hr)	Average load consumed with prepaid (W)	Monthly estimate bill before prepaid meter supplied (₦)	Monthly bill with pre-paid meter (₦)	Calculated bill expected (₦)	Variance (₦)	Differentials (%)
i.	1.5	76	2297.70	1154.37	1126.32	28.05	2.43
ii.	1	79	1655.67	1212.22	1170.78	41.44	3.54
iii.	2	54	1492.75	812.76	800.28	12.48	1.56
iv.	1	88	934.437	1345.78	1304.16	41.62	3.19
v.	1	93	1035.66	1418.69	1378.26	40.43	2.93
vi.	3	149	1789.56	2278.14	2208.18	69.96	3.16
vii.	2	134	1677.84	2026.67	1985.88	40.79	2.05
viii.	3	167	1897.63	2532.63	2474.94	57.69	2.33
ix.	1	75	897.33	1151.36	1111.50	39.86	3.59
x.	1.5	67	1045.67	1007.55	992.94	14.61	1.47
xi.	2	176	1556.95	2678.21	2608.32	69.89	2.68
xii.	2	104	1045.48	1597.29	1541.28	56.01	3.63
xiii.	1	161	1755.74	2426.82	2386.02	40.80	1.71
xiv.	1.5	73	1045.23	1124.24	1081.86	42.38	3.58
xv.	1	122	2467.62	1867.09	1808.04	59.05	3.26
xvi.	2	86	1745.51	1321.58	1274.52	47.06	3.69
xvii.	2.5	119	2412.83	1823.13	1763.58	59.55	3.38
xviii.	1.5	97	1050.47	1477.73	1437.54	40.19	2.80
xix.	2	213	2112.67	3204.22	3156.66	47.56	1.51
xx.	1	92	1057.36	1403.84	1363.44	40.4	2.96

In order to determine the correlation between the consumption charges, through estimated billing, pre-paid metering and the calculated bills for the loads, we use the spearman rank order correlation with the use of equation 2. It is obvious from Fig. 2 above that there is a disparity between the estimated and calculated billing system, the estimated bills does not show a true reflection of the energy consumed by the customers, hence the calculated and estimated graphs are not correlated as depicted in the graph.

The correlation of the results of Tables 5 and 6 is as shown in Tables 7 and 8, using equation 1. To interpret the result, which may vary between -1 and 1; when the result is close to -1, it gives a negative correlation, when close to 0, it gives no correlation, and when close to 1, it gives a positive correlation. There is a great correlation between the curves of prepaid and calculated billing systems as revealed by Fig. 3 above while estimated bill curve deviate from the two. This strengthens the fact that estimated billing system is disadvantageous to the interest of the electricity consumers.

$$\sum d^2 = 530.$$

with n = 20, and substituting into equation 1, we have; $\rho = 1 - (6x530)/20 \times 399) = 0.398$. This spearman rank correlation coefficient at 0.398 is a low value, which implies that there is little or no serious correlation between the monthly bill used to supply to costumers and the calculated bill expected for the consumption, giving rise to a null hypothesis.

Comparison of the estimated, prepaid and calculated energy billing is as shown in Fig. 4 with a wide deviation between estimated and prepaid as well as calculated billings.

$$\sum d^2 = 0.$$

with n = 20, and substituting into equation 2, we have; $\rho = 1 - (6x0)/20 \times 399) = 1$. This spearman rank correlation coefficient at 1.0 is a high value, which implies that there is a perfect correlation between the prepaid monthly bill used to supply to costumers and the calculated bill expected for the consumption, giving rise to a perfect monotonically related hypothesis.

5. CAUTIOUS: ACCEPTABILITY OF PRE PAID METERS AND REMARKS

The success expected on the use of prepaid metering system for energy management is hampered by the huge initial investment involved in supplying the meter to consumers by the utility companies. The laws that only restraints the utility companies to import and install the meters in consumer premises is also a barrier for the influx of the prepaid meters into the economy, to fast track the installations of such at consumer premises. One the part of the customer, the rapid changes in technology that brings about new facilities to easily rendered the purchased ones obsolete, with a need to switch over, and buy a newer recent ones to be able to get supply from

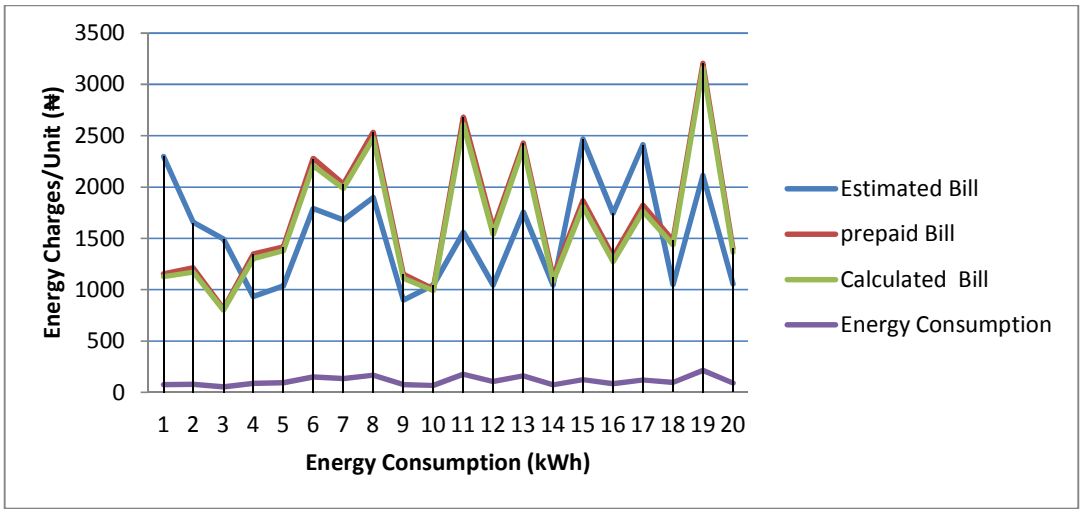

Fig. 4. Comparison of estimated, prepaid and calculated energy consumption billing systems

Table 7. Correlation between calculated monthly and estimate billing using spearman rank order

s/n	Monthly estimate bill (₦) supplied (Xi)	Calculated bill (₦) expected (Yi)	Rank order of monthly estimate bill (₦) supplied (rgXi)	Rank order of calculated Bill (₦) expected (rgYi)	Difference di= rgXi -rgYi	d^2
i.	2297.67	1786.74	16	16	0	0
ii.	1250.45	1318.98	7	10	3	9
iii.	1492.32	1007.76	11	1	10	100
iv.	1347.26	1111.50	8	3	5	25
v.	1235.85	1141.14	6	5	1	1
vi.	1656.62	1363.44	14	12	2	4
vii.	1577.51	1808.04	13	18	5	25
viii.	2397.26	1852.5	18	19	1	1
ix.	1020.71	1230.06	2	7	5	25
x.	1145.58	1422.72	5	13	8	64
xi.	2250.83	1674.66	17	15	2	4
xii.	1445.57	1189.34	9	6	3	9
xiii.	2455.11	1985.88	20	20	0	0
xiv.	1045.24	1304.16	3	9	6	36
xv.	1567.53	1333.8	12	11	1	1
xvi.	1745.47	1274.52	15	8	7	49
xvii.	2412.52	1793.22	19	17	2	4
xviii.	850.83	1126.32	1	4	3	9
xix.	1112.67	1585.74	4	14	10	100
xx.	1457.89	1096.68	10	2	8	64

Table 8. Correlation between calculated monthly and pre-paid billing using spearman rank order

s/n	Monthly estimate bill (₦) supplied (Xj)	Monthly bill (₦) with pre-paid meter (Yj)	Rank order of monthly estimate bill supplied (rgXj)	Rank order of monthly bill with prepaid meter (rgYj)	Difference Di = rgXj -rgYj	d^2
i.	1154.37	1126.32	5	5	00	00
ii.	1217.22	1170.78	6	6	00	00
iii.	812.76	800.28	1	1	00	00
iv.	1354.78	1304.16	8	8	00	00
v.	1418.69	1378.26	10	10	00	00
vi.	2308.14	2208.18	16	16	00	00
vii.	2026.67	1985.88	15	15	00	00
viii.	2532.63	2474.94	18	18	00	00
ix.	1151.36	1111.50	4	4	00	00
x.	1007.55	992.94	2	2	00	00
xi.	2678.21	2608.32	19	19	00	00
xii.	1597.29	1541.28	12	12	00	00
xiii.	2426.82	2386.02	17	17	00	00
xiv.	1144.24	1081.86	3	3	00	00
xv.	1867.09	1808.04	14	14	00	00
xvi.	1321.58	1274.52	7	7	00	00
xvii.	1823.13	1763.58	13	13	00	00
xviii.	1497.73	1437.54	11	11	00	00
xix.	3204.22	3156.66	20	20	00	00
xx.	1403.84	1363.44	9	9	00	00

the utility provider, is a concern which in many cases influence the readiness, and thus a delay in the choice of consumers since they are not guaranteed that the ones purchased will long last no matter the new technological changes. Moreover, customers that use more energy than the payments from estimated billing which is highly open to fraudulent activities, bribery and corruption, and are well connected to utility company staff in manipulation of bills, may be difficult to convince to change to pre – paid system which may be viewed as a way to stop them from cheating on the utility company and made them to pay more money for the energy consumed. Thus, there is a need for enforcement in the use of prepaid meters as one of the best ways to force customers to use only as much power they need for a particular time and situations, to reduce the waste of energy been experienced by estimated bill consumers, as well as corrupt acts, which will eventually lead to a drastic reduction in energy consumption, and improve the cash flow in the management of energy for the benefit of a larger population.

6. CONCLUSION

For a better energy conservation as well as need based energy management of resources, the pre – paid energy metering of costumers premises offers solutions to the experienced problems of lack of adequate supplies, corrupt acts been perpetrated by officials of utility companies at the costumer end and new possibilities. The reliability of the pre paid meters in measuring what is been use , as well as its billings is very high, and correlates with the expected with improved tolerance to date collection. The use of pre paid meters as a measure for need based energy management will help the consumers in no small measures of the need to adapt to the changing needs and requirement that introduces feature that give the consumers the ability to be flexible in their usage and at the same time eliminate loopholes of drains in the income of the utility company. Thus, there is a great need to improve on the customer's awareness of the benefits of the use of pre paid meters to enjoy a better reliability in the system. There is also a need to allow other interest group in the industrial chain to be able to supply costumers the prepaid meters with specified standard including meter data and history, data exchange format and software specification; that will make different energy service providers activation cards to be compatible in order to maintain the success of the prepaid billing system.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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