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Customer Satisfaction on Energy Sector Billing Process in Nigerian

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Abstract: **Customer satisfaction is the parameter used by marketing strategist to access the sustainability of product/service valuation and by extension the growth and overall development of the economy. The abysmal nature of the service provided by the Power Holdings Company of Nigeria PHCN to its customers is of great concern to researchers given the huge budgetary outlay apportioned to the sector; without valid result to match such huge disbursement/investments. The essence of study is to assess from the level of customer satisfaction by juxtaposing current billing process with the quantum of service provided by the energy sector, the study adapted the satisfaction function to elaborate on the disconfirmation theory as benchmark for evaluation. The issues to be examined in this study include; non-implementation of operational policy framework, mismatched billing parameters, and obsolete supply infrastructures. Descriptive survey technique was adapted to retrieve and collate data for analysis; using systematic review process, by adapting PRISMA protocol to accommodate diverse field of studies. The outcome of the study revealed that there is no correlation between service provided and the amount billed customers in the Nigerian Energy sector. Hence, the study recommended that; customer satisfaction could be actualized, if service providers in the energy sector could embark on a holistic measure; that will equate amount billed as energy used by customer, with the exact value of service provided by the sector to households. Identified gaps in the study were analyzed, to set the tone for future research.**

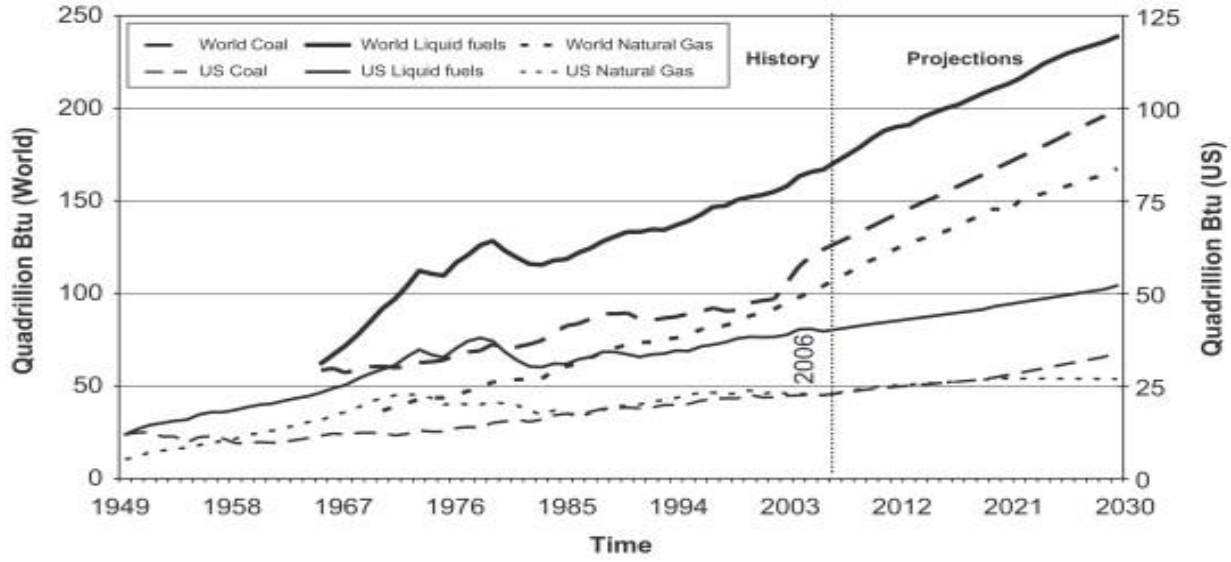
Keywords: **Customer Satisfaction; Billing process; Sustainability; Disconfirmation, Nigerian Energy sector.**

1. INTRODUCTION

The increasing impact of global warming and its effect on the ecosystem is traceable to human activity on the planet, one of such indices is the overall contribution of energy as a key driving factor towards actualizing the resolution adopted by United Nations (UN) on "Transforming our world: 2030 Agenda for Sustainable Development (United Nations, 2015a). Documented evidence has shown that global energy usage has risen astronomically between 1995 -2015 from 8,588.9 – 13147.3 million tones (Dong, et. al, 2020; & Ahmad; & Zhang, 2020). Base on the statistical data of world fossil fuel consumption, the World Energy Outlook 20006 projected that with precisely about 2% per annum growth in global energy consumption (Manson, 2007), Figure 1 shows fossil fuel as majorly contributing a projected 83% of global energy need by 2030 (International Energy Agency, 2006b). It is quite obvious with the above statistics on fossil fuel projected contribution attenuating that the SDG of attenuating the impact of energy production on the ecosystem still remain 'a pipe dream' based

on global energy demand realities. But the essence of this research is to assess billing and metering parameters adapted by the sector in evaluating energy consumption by customers.

Figure 1. World Fossil Fuel Consumption



Source: Shafiee, S; & Topal, E, An econometrics view of worldwide fossil fuel consumption and the role of US, Science Direct – Energy Policy, 36(2), 775-786**,** https://doi.org/10.1016/j.enpol.2007.11.002

Energy Billing Criteria

The process of billing/pricing irrespective of energy source**,** is the exclusive decision of each country; based on the national energy policy framework on what and how charges must be allocated/implemented, in some cases, the policy could create derivable parameter for billing each segment of customers. According to U.S. Energy Information Administration (EIA), The essence of energy tariff is to provide energy firms with investable capital to; procure, install, repairs and maintain generating plants, make adequate provision for the acquisition of transmission and distribution facilities (Rafał, 2014). This study basically focuses more on residential customer billing parameters; and as such, the global energy industry acceptable structures for residential energy rates include: i) the simple/fixed rate per kwh, ii) ranked rate based on usage, iii) Time of use (peak or normal period) iv) Usage rate v) Ranked based on time of use vi) periodic rates example: summer or winter seasonal charges and vii) weekend /holiday charges (Zheng, et. al. 2020).

In Nigeria, the pricing is based sectoral distribution which includes; i) residential ii) Industry, iii) Transport, iv) Commercial and public service v) non-specified vi) non-energy use vii) Agriculture and Forestry and viii) Fishing. the dilemma is that in Nigeria, the industry evaluation structure is scarcely applicable; thereby creating a gap in the industry billing process. Hence, customers are under compulsion by energy firms to pay for energy utilized through the 'draconian' estimated billing process' which does not equate with energy actually used by the customer within the billing period.

Transition to Global Sustainable Energy

However, figure 2 shows global future energy demand profile based on historical consumption trend 2020-2040 (Energy Data, 2018), this statistics anchors on the need to invest in transformative and sustainable energy sources that will reduce carbon (CO2) emission, and advertently impact positively on the climate change crisis on our environment, based on International National Determined Contribution (NDC) agreement for United Nations Conference on Climate Change (UNCCC) tagged COP21 (United Nations, 2015a., United Nations, 2015b). Globally, most countries have made commitments to the gradual/drastic measures towards reducing its carbon footprint; For instance, available data shows effort by; Germany which takes the lead with a projected 80% reduction in CO2 emission by 2050, (Henning; & Palzer, 2015; & Sterchele et al.,2017)., with drastic policy implementation framework towards accomplishing sustainable energy targets in its projects (Emonts et al., 2017). Canada has also prepared a projected policy framework for sustainable energy and reduction in CO2 emission (Canada and Canada, 2017).

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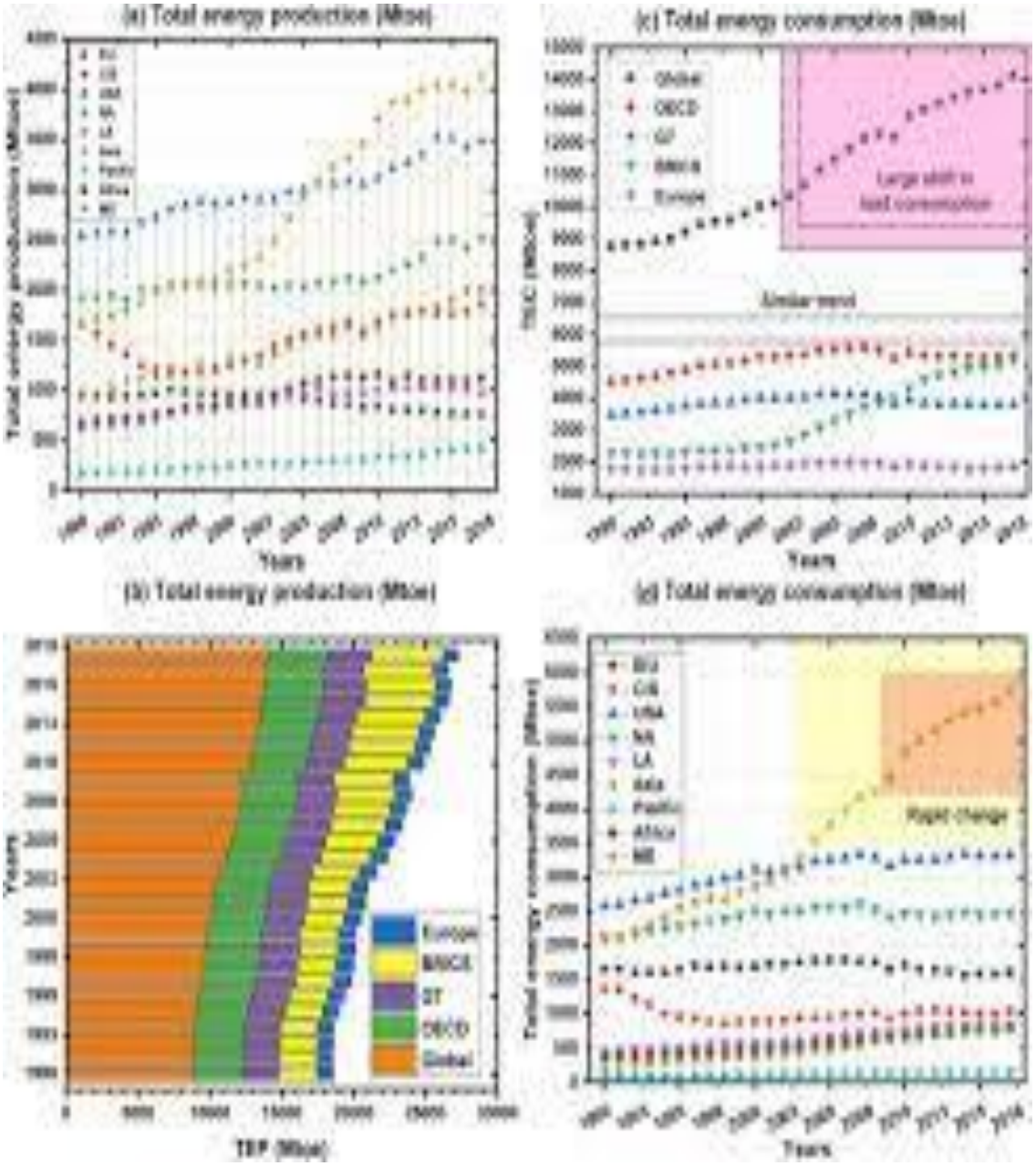
Figure 2 Historical energy consumption and projected future demand profile



Ahmad; & Zhang, (2020), A critical review of comparative global historical energy consumption and future demand: The story told so far, 6. 1973-1991, https://doi.org/10.1016/j.egyr.2020.07.020,

The European Union (EU), its 28-member state have made frantic effort towards reduction in its carbon footprint for the manufacturing industry and power plants, through the European Union Emissions Trading System-EUETS (Brandt; & Svendsen, 2016). For USA which is leads in global crude oil production with estimated 16.6 million barrels per day in 2021 (Wu' & Chen, 2019; & Ji, & Fan, 2016). and the emerging economies such as; India and specifically China, the demand for fossil fuel keep surging based on increasing demand by its manufacturing sector; hence constant increase in carbon emission by these nations rises unabatedly (Wu' & Chen, 2019; & Ji, & Fan, 2016). For developing countries such as Nigeria is which the domain of this research, documented evidence has shown energy data availability on only petrol and gas; with little or inconsistent data on current/projected green and sustainable energy framework, (Energy Data, 2021). Hence non existing and inconsistent energy data has been identified as a gap in the current study. In essence, the carbon footprint for these nations still remains a threat to the ecosystem and key driver of current climate change challenges.

The Nigerian Energy Sector Experience

The global energy experience based on source seem to repeat the same trend in Nigeria, documented evidence has shown that the key derivative of energy generation in the country is fossil fuel represented by over 80%, with the remaining balance originating from hydro energy and other sources (Oyewo, et. al, 2018). The important role of energy in driving all sectors of the economy towards actualizing the industrialization dream of most nations cannot be overemphasized, Energy is the supposed 'life blood' that transform nations, cities, people and lives. In Nigeria, the deplorable nature of service provided by the Nigerian energy sector could be tagged as 'a gloomy experience' based on the increasing level of customers' perceived dissatisfaction when comparing what is billed and the quantum of service provided by the energy sector. The complaints by customers both public and private transcends geographic, demographic, psychographic and behavioral logic; because of the inability of the energy service providers to equate service delivery with billable amount as service charges for energy consumed.

Historically antecedent has it that the energy sector in Nigeria started in 1896 with electricity generation in Lagos only, the introduction of legislation in 1950 that named it as the Electricity Corporation of Nigeria – ECN, which empowered Lagos to generate and supply electricity (Simpson, 1969). In 1972, following the end of the civil war, Decree No 24 was enacted which renamed Electricity Corporation of Nigeria (ECN) as National Electric Power Authority (NEPA). The National Electric Power Authority (NEPA) gave birth to Power Holding Company of Nigeria (PHCN), following the enactment in 2005 of the Electric Power Sector Reform Act by the Federal Government of Nigeria. (Igbokwe J& Emingini, 2004). In 2010, 'the Power Sector Roadmap' to drive the energy sector reform project as a key towards kick-starting the industrial revolution in the country. Following these reforms, the power sector was unbundled into three functional units with independent companies known as; i) one single Transmission Company of Nigeria (TRANSYSCO), ii) Generation Company of Nigeria (GENCOS) having six (6) independent companies and, iii) Distribution Company of Nigeria (DISCOS) having eleven (11) independent companies. In whatever name, shape or form it takes, the most important issue to the consumer is; because all the reforms have not translated to 'value added service delivery (Emaeka, 2008)

Various studies have been conducted on diverse issues affecting the Nigerian energy sector such as; service providers lack of capacity to manage available facilities - Transmission, Generation and Distribution (Igbokwe; & Emingini 2004). Administrative Policies and Service Delivery (Popoola; & Fadare, 2016), Survey based analysis of Infrastructural failures (Adenikinju, 2003), adaptation of voltage stability index to measure voltage collapse in power system networks, (Samuel, et. al, 2017), electricity industries issues, challenges and solutions (Awosope, 2014), evaluating consumer willingness to adopt the prepaid billing system (Oseni, 2015), Cost implication of line voltage variation on three phase induction motor operation (Adekitan, et. al, 2018), Smart campus: data on energy consumption in an ICT-driven university (Popoola, et. al, 2018) and Electricity billing systems and household electricity use behavior {Arawomo, 2017). The current study shows a deviation from existing works conducted in this field of study, by attempting to fill the gap in literature. Hence, a holistic examination of customer satisfaction/dissatisfaction based on value added services on one hand, and provision of specific data that reflects on the exact quantum of service delivered to the customer by energy firms.

Billing Issues in The Study Area

This study was conducted in Akwa Ibom State, Nigeria under the Port Harcourt Electricity Distribution (PHED) Plc, which Akwa Ibom State is domiciled. Respondents were selected from three districts: (Uyo, Eket and Ikot Ekpene). Some customers are of the view that over 70percent of the amount billed for energy supplied, does not reflect the service rendered by the energy service provider, but they have to pay for fear of being disconnected from the national grid by the firm. This has resulted in protests by customers to the government to prevail on PHED to make available to all customers in the state 'prepaid electrical billing meters' for the purpose of transparency and accountability in the billing process.

According to a survey conducted by Philip Consulting, the high level of disaffection as expressed by customers on the three billing platforms namely; a) Post-paid electricity billing, b)Pre-paid electrical billing and, c)Estimated electrical billing platform; PHCN customers are dissatisfied due to; a)excessive tariff that does not match the quantum of electricity supplied within the billing period, b) Variation in voltage supplied by the energy authority, c) Unexplainable charges that does not match supply by the same service providers, d)Non availability or refusal to provide other metering platforms at customers disposal, for effective billing service switch, e) Overloaded electrical infrastructure resulting in frequent outages of electricity, f) Ineffective feedback procedure to handle customers complaints and, g)Below standard end users service that needs complete overhaul in Power Holding Company of Nigeria. (Philip Consulting, 2013),

Problem of the Study

The high-level discontent, apprehension and frustration amongst customers of Power Holding Company of Nigeria (PHCN) is better experienced than imagined. It is sad but real to state herein that with a population of about 180million in the country, as the population is on the increase, electricity generation and distribution capabilities is on the decline without any strategic measure to arrest the trend. It is common experience that most transmitting infrastructures are obsolete, and as such, not capable to deliver the quantum of energy released by the GENCO firms to the DISCOS for onward distribution to end users; resulting in load shading, epileptic supply or total blackout.

The travail of energy customers is complicated by mis-matched billing parameters adopted by energy firms, most energy firms are still billing customers for service not rendered using post-paid or estimated meter billing platform. The study revealed that energy billing is based on apportionment to customers (especially estimated customers – 'the cash cow') based on total energy supplied by GENCOS to DISCOS. Further enquiry revealed that for DISCOS are under obligation to pay for the quantum of energy supplied by GENCOS, in order to fill the 'revenue gap', hence DISCOS must have to apportion charges to customers, irrespective whether they were actually supplied within the billing period under consideration or not. This practice of billing for services not rendered, is viewed in the researchers' assessment as 'wrong, unprofessional and unethical', impacting negatively on the overall national Gross Development Product (GDP) of the county at large.

The non-implementation of operational policy framework by government has adversely Impacted on the sector, the unbundling of the moribund NEPA to PHCN was supposed to transform the sector to an efficient, dynamic and technologically competitive energy industry with global peers, but the issues of bureaucratic bottlenecks, mismanagement of funds allocated to the sector, hydra headed 'corruption', non -engagement of global experts in core technical sections of the sector; has continually delayed the accomplishment of the various reforms targeted at liberalizing the energy sector.

Objective of the Study

The main objective of this study is to determine the effect of customer satisfaction on billing process in Nigerian energy sector. However, the specific objectives of the study are to: To assess the of effect of obsolete transmission facilities on customer satisfaction in energy sector in Nigeria, to examine the complicated mis-matched billing parameters adopted by energy firms, by billing customers for service not rendered, and the non-implementation of operational policy framework, meant to reposition the energy sector by the government.

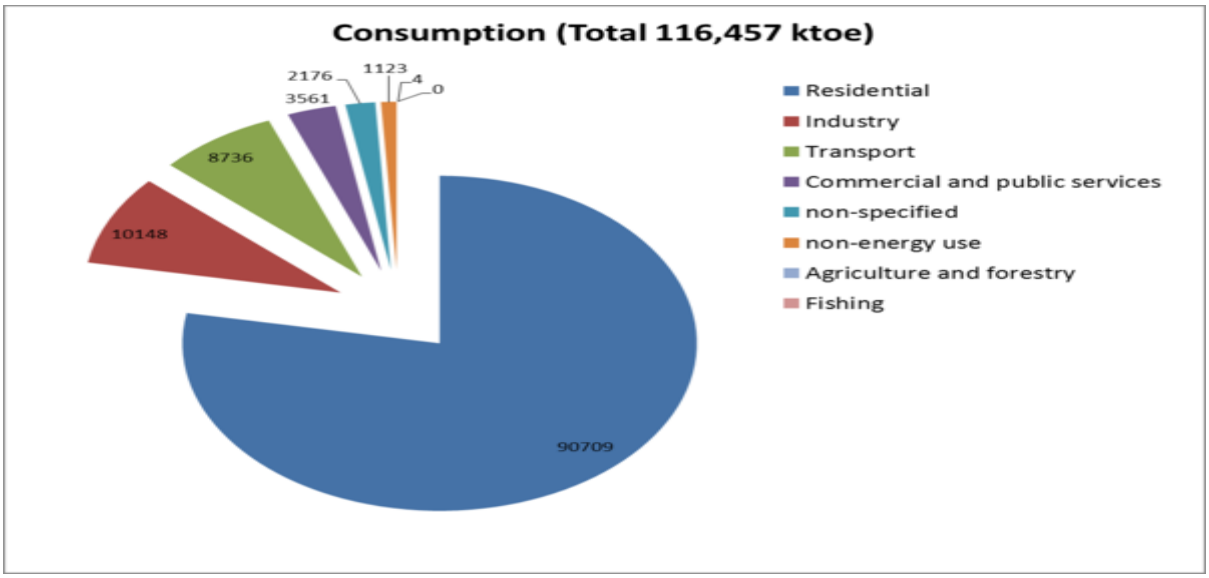
2. LITERATURE REVIEW

All over the globe, the need for electrical energy has become a commonplace for enhancement of daily family routines, operating plants and machineries that produce goods and services needed by various households and running of government and private businesses around the world for the purpose of making life comfortable. It becomes pertinent, to measure the quantum of electricity used by individuals, businesses and Governments. Electricity billing system is a mechanism that estimates with some level of precision the quantum of electrical power used up by individual or businesses both private and public through the use of an electronically driven gadget (Md Masudur, et. al. 2015).

The global ratio of people without energy is 2:8 ratio (Panos et al., 2016). Based on available data to International Energy Agency (IEA) report for 2010 was 1,267million (IEA, 2011; OCDE/IEA, 2012) and between 1,267 – 1285million, this figure could be higher based on non-availability of data in most region of the such as; Africa, Asia and Latin America (IEA: Directorate of Global Energy Economics, 2014). The dilemma for that of Africa, specifically in Nigeria, an estimated 60% of the population is yet to be connected to the national grid, the authorities intend to adapt an off-grid Photovoltaic (PV) system which is estimated to gulp about 5,6billion USD (PHCN – Project Management Unit, (2009), This report in Nigeria shows a wide unbridged gap in energy provision to the populace irrespective of the source of energy.

The total energy consumption in the country in 2012 is estimated at 116,457Ktoe shared amongst different sectors, with residential sector having the highest percentage of 90,709Ktoe (77.89%), others include: Industry 10,148Ktoe (8.71%), Transport 8,738Ktoe (7.50%), Commercial and public service 3,561Ktoe (3.06%), non-specified 2,176Ktoe (1.87%), non-energy use 1,123Ktoe (1.31%), Agriculture and Forestry 4Ktoe (0,0034%) and Fishing (Nil). The breakdown in Figure 3; with the highest quantum of energy consumed by residential compared to industrial consumption, a ratio of 7:1 for residential and industry reveals n industrialization a gap in the utilization of energy for the production of goods and services, based on World Bank historical population growth rate of 2.44% projection for year 2021, the countries' population is estimated at 213,401,323, the sectoral energy distribution is grossly inadequate to drive economic activities and the standard of living of the populace.

Figure 3: Sectoral Energy Consumption in Ktoe



Source: International Energy Agency (IEA), 2015;

http://www.iea.org/statistics/statisticssearch/report/?year=2012&country=NIGERIA&product=Balances

Documented evidence has also shown in Table 2 that, between GENCOS and TRANSYSCO energy losses incurred in megawatt as presented by Nigerian Energy Regulatory Commission NERC, in its quarterly report. But the cost associated with this loss is still transferred to estimated billing customers to pay, this is due the fact that; each of these firms (GENCOS, TRANSYSCO and DISCOS) must be able to recover their investment; regardless of where the blame should be apportioned and the cost allocated thereat.

Table 1: Loses incurred in Megawatt between GENCOS and TRANSYSCO

Month/Year	Available capacity (MW)	Average daily generation	Average daily shortfall (MW)	Percentage Representation
January 2018	**7,457**	**3,744**	**3,713**	**50.21%**
February 2018	**7,215**	**4,005**	**3,210**	**55.51%**
March 2018	**7,475**	**4,079**	**3,396**	**54.57%**
April 2018	**7,250**	**3,999**	**3,251**	**55.15%**
May 2018	**8,034**	**3,827**	**4,207**	**47.63%**
Total	**37,431**	**19,654**	**17,777**	**52.51%**

Source: Nigerian Energy Regulatory Commission "NERC (2018), Quarterly Reports". *www.nerc.gov.ng*.

Table 1 shows that between the months of January 2018 – May 2018 represented by an average five month total shortfall of 52.51%, the losses attributable to: obsolete transmission facilities, vandalization of GENCO infrastructures, insufficient number of key experts, gas supplies shortages to generating plants and corruption within the hierarchy was responsible for the huge gap of energy losses incurred by generating firms, but not transmitted to discos for onward distribution to the final consumer. It should be noted at this point that, this daily average losses not transmitted to DISCOS, must be fully accounted for by energy transmission firms..

Energy Billing Services in Nigeria

Available documentation shows that in 2014, the government through its regulators gave license to 138 companies categorized as; meter manufacturers – 5; importers – 13; vendors – 28, individual installers and corporate installers 79 (Vanguard, (2014), The energy billing services is riddled with quite a number of challenges as shown in Table 1, on distribution companies network status, for the purpose of this research, the focus will be on PHED in which district under study is domiciled. A close study shows available capacity (MV) to be 486MV with a peak load demand of 773MV, this

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shows peak demand about twice available capacity (MV), and the customer base for the period under consideration is 2008. It must be noted that in PHED, distribution losses (%) is showing NA. This further clarifies the frustration faced by customers based on persistent non processing of vital information on energy challenges, a clear case of lack of skilled personnel to deliver on customer feedback issues, as well as sub-optimal distribution network.

Table 2: Distribution Companies Network Status

Name of company	Owner*	Purchase Value ($ Million)	Coverage	Length of lines							Distribution losses (%)	Capacity (MW)	Peak Load Demand (MW)	Customer based (as at 2008)
				Overhead			Cables			Total				
				33KV	11KV	LV	33KV	11KV	LV					
Abuja	Kann Consortium Utility Company Plc	164	FCT, Niger, Kogi and Nasarawa	3,312	3,804	3,520	0	355	262	11,253	35	515	835	469,306
Benin	Vigeo Power Consortium	129	Edo, Delta, Ondo and Ekiti	4,133	5,168	12,576	11,146	132	150	33,305	21	392	100	529,341
Eko	West Power & Gas	135	Lagos South	545	2,347	3,980	317	462	262	7,913	18	796	1105	266,075
Enugu	Interstate Electrics Limited	126	Enugu, Abia, Imo, Anambra and Ebonyi	4,092	3,210	20,558	4	178	213	28,255	6	612	1017	545,103
Ibadan	Integrated Energy Distribution and Marketing Company	169	Oyo, Ogun, Osun and Kwara	8,088	4,594	11,401	0	462	407	24,952	8	878	1193	812,000
Ikeja	NEDC/KEPCO	131	Lagos North	7,711	2,730	25,742	12	110	262	36,567	18	854	1335	535,692
Jos	Aura Energy Ltd	82	Plateau, Bauchi, Benue and Gombe	3,930	1,395	12,152	0	20	56	17,553	22	378	507	277,826
Kaduna	Sahelian Power SPV Ltd (Not fully privatized yet)	58	Kebbi, Doka, Gusau, Mak	1,533	1,614	6,535	5	145	93	9,743	25	344	520	285,736
Kano	Sahelian Power SPV Ltd	137	Kano, Jigawa and Katsina	3,583	1,253	2,351	4	156	17	7,364	40	365	596	489,655
Port Harcourt	4 Power Consortium	124	Rivers, Cross River, Bayelsa and Akwa Ibom	6,109	9,747	n.a.	n.a.	n.a.	n.a.	15,856	n.a.	486	773	347,789
Yola	Integrated Energy Distribution and Marketing Company	59	Yola, Adamawa, Borno, Taraba and Yobe	8,761	1,407	21,485	0	2	25	31,680	22	138	176	189,347

*State governments are shareholders in the DISCO that operates in their territory. Ikeja also counts with a private stakeholder: Sahara Energy
**Table created only for indicative purposes. The information included might not be complete or up to date

Nigeria has the least average electricity consumption per inhabitant between (2006 -2012) is about 109kwh per capita in 2006 (Oseni 2011), and 150 kWh per capita Eleri, et, al (2012). Energy challenges in Nigeria has become one of the key indices limiting industrialization, overall economic growth and development. According to The Council for Renewable Energy of Nigeria (CREN), the country losses US$ 984 million annually due to energy challenges. (PHCN – Project Management Unit, (2009). Based on the devastating effects of fossil fuel on the ecosystem as experienced in the current climate change dilemma, Government and key stakeholders in the sector must' by match words with action' by providing enabling legislative policy regime, that will eliminate all barrier towards procurement, generation, distribution and effective billing process for renewable energy (Prehoda, et. al. 2019). If this suggestion is implemented as embarked by other nations striving for clean energy sources; it will close the gap in the anticipated transition from fossil fuel to sustainable energy sources in Nigeria.

Types and Sample of Billing Infrastructures in Nigeria

i) Estimated Electrical Billing System

Figure 4: shows samples of estimated energy billing meters, these forms of billing system were analogue metering systems installed by the moribund NEPA, estimated billing includes customers with the analogue meter and customers that do not have any metering facilities. According to NERC third quarter 2020 report, out of the 11,841,819 registered customers of PHCN, only 4,425,628 representing 37.37%, hence, an estimated 7,416,191 representing 62.63% of total electricity

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consumers in Nigeria are evaluated through the estimated billing system. This billing facility was acquired by PHCN for the purpose of evaluating the quantum of energy consumed by the user as well. In the course of this research, energy consumers' have affirmed that they are always served with outrageous monthly bill that does not reflect the total energy consumed within the billing period. Customers also affirmed that every effort to correct this anomaly is rebuffed by the energy firm.

Figure 4: Estimated electricity billing devices – Post Paid

Adapted: Ripples Nigeria

The process of billing by DISCOS in Nigeria follows a specified pattern based on the energy policy framework, which empowers each DISCO to provide metering facilities (post-paid - estimated) and bill customers for energy used within a specific period. For the purpose of clarity in this research, the customer billing format for each of the six (6) geopolitical zones are listed in figure 5 as follows: a) South West – Eko Electricity Development Company (EKEDC), b) South-South-Porth Harcourt Electricity Development Company (PHED), c) South East – Enugu Electricity Development Company (EEDC), d) North East – Adamawa Electricity Development Company, e) North Central, Jos Electricity Development Company and f) North West, Kano Electricity Development Company, (KEDC).

Figure 5: Six Geo-Political Electricity Billing Format

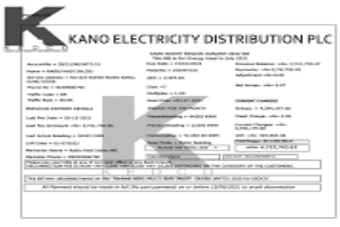
a)


b)


c)


d)


e)


f)


ii) Automated Electrical Billing System

This are smart energy billing mechanism which automatically computes total energy used by consumers within a specific billing period, the billing is prepared by the energy firm, and forwarded to the customer at the end of the billing period. Automated billing system though post-paid, shows transparency on the billable amount compared to the estimated analogue system still in use by over 62.63% of energy users in Nigeria. This billing system is mainly installed for corporate entities such as blue-chip companies, high-brow residential estates in urban settlements and Government Reserved Areas (GRA). Automated billing system shows transparency and customer accountability to bills generated through this process, hence

automated billing customers are satisfied since the billing represents the quantum of energy already consumed within the period.

Figure 6: Automated Estimated electricity billing devices – Post Paid

a) b) c) d) e)

a) Generic WiFi Power Meter For Household -Jumai.ng.com, b) Power Meter Energy Monito - Konga.com **c)** Meter Power Watt Voltage Amps With Backlight - Jumia.ng.com d) High Quality Nigeria Low Voltage Residential Anti-Fraud Din Rail Keypad Split Prepaid Electric Energy Meter – Alibaba.com e) 3 Phase STS Prepaid Energy Meter For Nigeria Market - Alibaba.com

The automated billing system in Figure 6: has a video device mounted on the meters to capture detail image of meter reading at end users point, based on the agreed billing period. The data is processed with MATlab software to compute and save the information. Where customers owe bills prior to the current month, the software deducts it automatically to arrive at the monthly bill for the customer and a copy sent to the service provider for billing confirmation (Markose, et. al, 2016).

iii) Prepaid Electricity Billing System

The pre-paid energy billing system in Figure 7; was born out of the need by researcher to solve the problem of billing customers for energy not used, Energy loss due to wastage and misuse resulting in economic wastage to the nation. Researchers are of the view that with the consistent rise in the price of global energy, the prepaid electricity billing system was proposed to help conserve energy and to prompt energy users that 'conserving energy means saving money'.

Figure 7: Prepaid Billing Devices

f) g)

f) Schneider Single Phase Original Meter – Lozap Nigerai b) 3 Phase 4 Wire Energy Meter 230/400V 5-100A Digital Electric Power Meter Energy Consumption KWh Meter Rail Type Installation 35mm – ubuy Nigeria

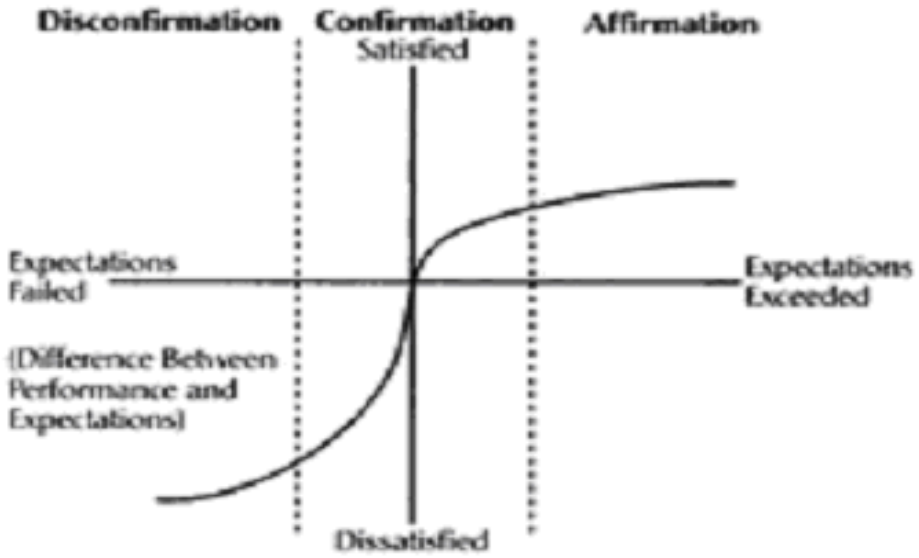
This billing system is electromechanically powered to compute the rotation of an electrically driven disc of metal that counts the rate of its revolution which is equal to the energy utilized through the gadget. Electronic meters on the other hand exhibit the power utilized using LCD or LED as its display window. It can also display a framework of energy in transit, electromagnetic force and its rate of utilization required by end users. The level of precision of prepaid electronic billing eliminates the possibility of mistakes due to human error (Markose, et. al, 2016). The prepaid energy system is preferable because, the massive development experienced in the Nigerian Mobile Telecommunications sector is due to the introduction of the prepaid 'pay as you go' billing system; in the customers view, prepaid billing connotes equitable 'value for service delivered'.

In retrospect, this research was conducted to juxtapose the estimated billing and electronically powered billing system based on customers dissatisfaction with the criteria adapted by the energy sector in allocating the estimated billing to users. Hence, this study is an attempt to close the existing gap in billing process by proposing a total elimination of estimated billing, and replace the process with the electronically powered system (automated or prepaid)

The Customer Satisfaction Function

Satisfaction of customers is the core reason why owners of businesses invest in diverse undertaking (Adrian, 2002). The process of quality of service delivered in Nigerian energy is crucial to the growth and survival of the energy businesses (Oseni 2011). Figure 8; shows that consumers at any point in time, have certain level of expectation in service consumption, if at any point, the service delivered falls short of what the consumer expected, it results in the consumer being Dissatisfied. Paulin, et. al, (2016), posited customer satisfaction to be attained at a level where the customer derive fulfillment from a specific service delivery. This is quite important because once customers are satisfied, they become loyal and engaged to products brand, to the extent that; they now become advocates to firms' product brand (Shen, 2000)

Figure 8: Customer Satisfaction Function



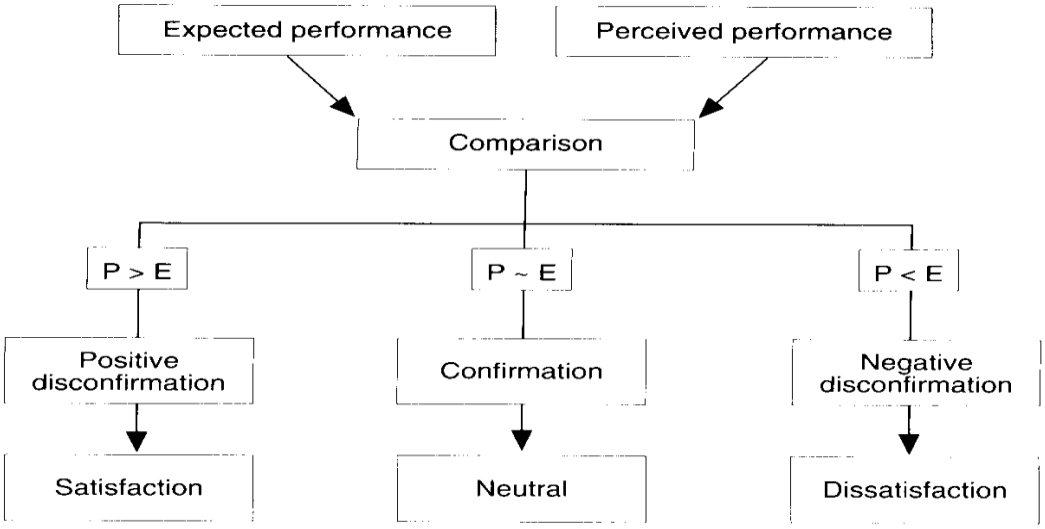
Adopted: Anderson; & Sullivan, (1993) The Antecedents and Consequences of Customer Satisfaction for Firms. Marketing Science, 12, 125-143, http://dx.doi.org/10.1287/mksc.12.2.125

Customer satisfaction explains the assessment of energy product offering at the disposal of the customer, if the service delivered meets the expectation of the customers (Liu, et. al, 2008). In service architecture, customers are the most important element that could translate firms' vision to realism. (Babatunde; & Olukemi, 2012). However, several research gaps has been identified when adapting the customer satisfaction function in the energy billing subsector, these include; accomplishment of customer expectations based on customers' viewpoint (Beatson, et. al, 2007), need for a holistic appraisal of service offering delivered by the energy sector in Nigeria in line with best practices as it affects customer satisfaction on the billing process in the country (Popoola. & Fadare 2016; & Abdullateef, 2013), and customers assessment of energy service providers based on the totality of the overall service delivery within a specified billing period (Reinders, et. al, 2008)

Disconfirmation Theory

The Disconfirmation theory according to Ekinci; & Sirakaya (2004),, asserts the concept of 'satisfaction is comparable to the magnitude and bearing of encounter that took place due to the process of juxtaposing service accomplishment with a presupposed conception', this concept is also supported by Mattila; & O'Neill (2003).. Also, Petrick (2004)..in citing the works of Szymanski and Henard in meta-analysis, posits that the disconfirmation framework is the foremost determinant of customer satisfaction.

Figure 9: Disconfirmation Theory



Adapted: Disconfirmation Theory: Ekinci; & Sirakaya . (2004), in Anderson, (1998). Customer Satisfaction and Word of Mouth. *Journal of Service Research*, *1*(1), 5–17. https://doi.org/10.1177/109467059800100102

Mattila, & O'Neill, (2003) posited that Disconfirmation theory consistently argues that satisfaction is interconnected the proportion and direction of customers when juxtaposing actual service consumed and customer expectation The process in which the service offering is implemented is quite important as well (Oliver, 1980). When the customer compares the pre and post service experience, its enables the customer to determine if the service experience resulted in either positive or negative disconfirmation (Anderson, 1998) Citing Oliver, (1980), Ekinci & Sirakaya (2004), made a proposition on disconfirmation theory, that "the direction of Satisfaction after consuming a particular service offering, can only be evaluated by the customer based on the outcome of the customers expectation.

The foregoing affirms that, satisfaction of customer on a particular product offering is dependent on customers direct encounter with products / service offering (Mattila; & O'Neill, 2003). In essence, adapting disconfirmation theory in the energy sector could act as an indicator of the level of satisfaction expected by customers, and the quantum of service offering energy firms have to provide in actualizing the satisfaction of energy customers in Nigeria.

Conceptual Framework on Energy Sector Billing

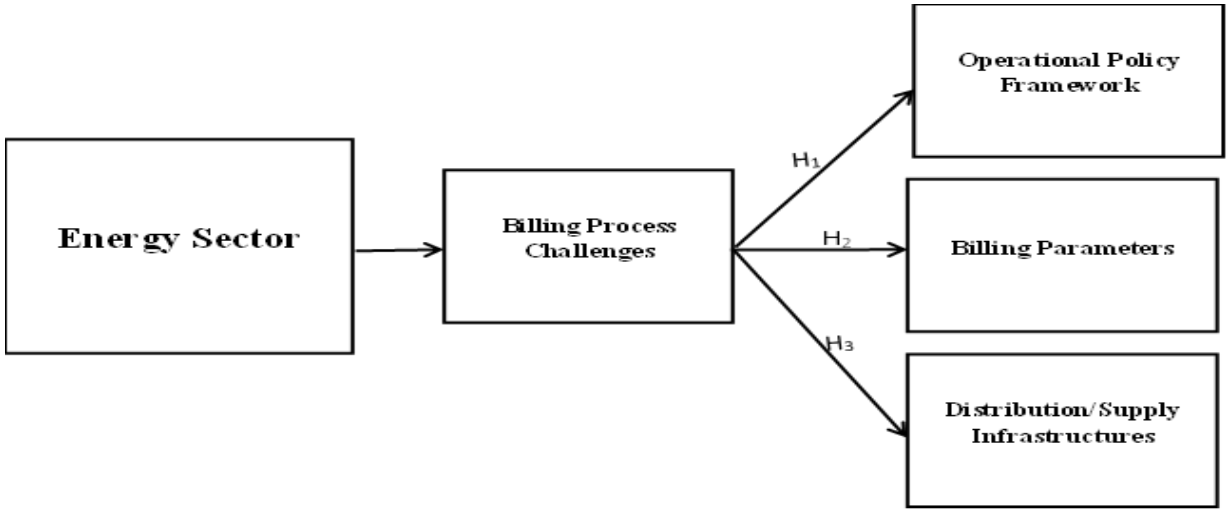
The associated benefit of providing energy is to create added value to the livelihood of various households, improve national economic wellbeing and fast-track the process of technological development. The sector is acknowledged globally as the key index in wealth creation, industrialization and sustainable socio-economic development (Bouzguenda et al., 2019; Iddrisu; & Bhattacharyya, 2015; & Jefferson, 2006). The framework of the National Energy Support Program (2014), energy billing process flow transits from; GENCO>>TRANSYSCO>>DISCOS>>CUSTOMER, but this process is truncated due to diverse challenges (Awosope, 2014). Figure 10 shows the issues encountered in optimal energy delivery (Sambo, 2008), that could equate the quantum of billing to customers is due to; i) ineffective implementation of policy framework, ii) mismatched billing parameters, and iii) obsolete distribution/supply infrastructures.

Implementation of Energy policy Framework:

The energy policy framework targeted 16,000MW in 2016, and Roadmap for Power Sector Reform targeting 32,000 MW of energy by 2020, all these projections have fallen short of expectation; since the current power generation is estimated at 11,165.4 MW. This has resulted in the sector still falling below; with the least average electricity consumption per person estimated at 109kwh per capita between 2006 -2012- Oseni, (2011), and 150 kWh per capita Eleri, et, al, (2012). The resultant effect of the low kwh energy per capita is consistent blackouts and energy outages, hence most individual energy users have invested in self-generation of energy (fuel and Diesel) estimated at about 6000MW in 2009, which adds to the already complicated CO2 emission (PHCN report, 2009). This process is unsustainable, and in contradiction with UN SDG

on energy signed by developed and developing nations tagged '2030 Agenda for Global Development of SDGs and Corporations' (Omer; & Noguchi, 2020; Ahmad; & Zhang, 2020, Akuraju et al., 2020; Alawneh et al., 2019; & United Nations, 2015a).

Figure 10: Critical Issues in Energy Billing Process



Mismatched Billing Parameters

The billing parameters in the study includes; estimated billing, automated billing and pre-paid billing platforms, estimated billing platform with an estimated 62.63% has proven to be the most unreliable/controversial amongst the three platforms (NERC, 2020; Adekitan, et. al, 2018; & Arawomo, 2017). Estimated billing system has become the 'cash cow' for the firm for milking enough revenue to cover outstanding shortfalls in income duet to abysmal performance of the units that make up the organization. This platform lacks the basic elements of accountability and transparency (Markose, et. al, 2016); hence, the insistence for a more transparent platform 'prepaid billing' that could match billing with energy consumption by households.

Distribution/Supply Infrastructures

The focal point of this framework is the determination of the key issue which creates disaffection between customers and energy billing firms, this is traceable to obsolete distribution infrastructures; which lacks the capacity to transmit usable energy from the supply point to the end user (Awosope, 2014). Based on NERC 2018 quarterly report, between January and May of the year under review, an average daily loss of17,777MW of energy representing 52.51% was not transmitted by transmission firms from GENCOS, this loss is basically due to failed equipment/infrastructures, vandalization, insufficient skilled/expert personnel and hierarchical corruption/misappropriation of funds. Als, between DISCOS and the final energy consumer, Issues such as; blackouts, load-shading, and other abysmal service experience is the resultant effect of; obsolete equipment such as transformers, unskilled personnel, poor response rate, sharp-practices and faulty feedback procedures culminates to the existing sub-optimal performance of the energy sector.

The foregoing issues; have resulted in a huge gap between demand and supply of energy by the firm; resulting in customer disconfirmation; a situation where customer expectation there is a gap between customer expectation and actual service delivered by the energy firm (Eshiett, et. al. 2018; Ekinci & Sirakaya 2004; & Mattila, & O'Neill, (2003).

3. RESEARCH METHODOLOGY

The structured systematic review process was adopted to evaluate its application in social and management sciences (Papaioannou, et. al. 2010; & Bilotta, et. al. 2014). changing pattern in consumer behavior and preferences necessitates firms to reappraise their operational paradigm in line with sustainable energy delivery services (Ahmad, & Zhang, 2020; Energy Data, 2018; & United Nations, 2015a), a lot has been achieved with this approach in Health Sciences (Rethlefsen, et. al, 2021: Papaioannou, et. al. 2019; Firestone, et. al, 2017; Bearman; & Dawson, 2013; Evans, et. al, 2011; Grant; & Booth, 2009), In socio-environmental issues (Gough et. al. 2017, Petticrew; & Roberts, 2006; and in recent times adopted

as a holistic measure in resolving general research methodological challenges in diverse areas of study (Coon, et.al, 2022; & Tsafnat, et. al, 2014); for the purpose of this study by creating sustainable research approach in customer service management constructs (Durach, et. al. 2017; & Tranfield, et. al. 2003), specifically in energy and related billing/metering processes (Adekitan, et. al, 2018; Oseni, M, 2015, Md Masudur, et. al, 2015). The authors wish to clarify at this that; the augmentation of the methodological approach is to match current research expectations, Hence, an improvement in the presentation of this work (Eshiett, et. al, 2018), by augmenting the methodological process with PRISMA to bridge the gap in methodology in power generation (Eshiett,; Abubakar; & Eshiett, 2019), , by adapting multidisciplinary research approach from the various fields considered in the study.

Review Framework

The basis of the review is the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol, this is to bridge the difference in diverse fields of study involved in the research process, for the purpose of establishing a solid conceptual foundation with an ascertained study objective (Tricco, et al. 2018), continuous updated guidelines (Page et. al, 2021)), elaboration and explanations on systematic reviews (Page, et. al, 2021), for consistency and reliability in multidisciplinary studies (Rethlefsen, et al.2021) and to create a basis to critically examine customer satisfaction and energy billing process (Eshiett, et. al, 2018). PRISMA protocol allows for the adaptation of various methodologies, based on its affirmed consistency, reliability and validity (Bearman; & Dawson, 2013, Silva, et al 2012);, which is in consonance with methodological procedures in service marketing sciences (Durach, et. al. 2017; & Tranfield, et. al. 2003

The methodology for data collection and analysis was based on multi-disciplinary methodological procedures adopted in management sciences (Papaioannou, et. al. 2010; & Bilotta, et. al. 2014), and service marketing (Singh, 1988; & Zeithaml, et. al 1988). Adequate care was also taken to ensure that the sample for the study was obtained directly from registered customers of PHCN witin the area under study PHED.

Sample Size and Sampling Method

This study sample was 286 at 5% level of significance, by adapting determination of sample for a given population of about 1,000 (Yamane, 1974), the respondents were registered customers of PHED, questionnaires were administered at (Uyo, Eket and Ikot Ekpene) district, and comprehensive interviews were conducted to elucidate issues in which the questionnaire could not clarify. The study was designed to access customer satisfaction on Billing Process in Nigerian Energy Sector. A breakdown of the population revealed that Uyo district had 120(42%), Eket district 97(34%) and Ikot Ekpene district 69(24%). Stratified random sampling technique was used for the stochastic perspective of enabling each member of the population have a fair chance of being selected (Saunders, et. al. 2016; deVaus, 2002). The demography include; age, gender, marital status, and education. The rationale for this procedure was to ensure fair representation of responses, respondents were carefully sampled to ensure accurate representation for relevant demographics. The essence of the interview was to obtain an in-depth information about the respondents' perspective of service offering in the energy billing process in Nigeria with respect to customer satisfaction

Table 3: Questionnaire Administration schedule

Categories	**Frequency**	**Percentage**	**Cumulative**
Unreturned questionnaire	11	4	4
Unusable questionnaires	20	7	11
Usable Questionnaires	255	89	100
Total	**286**	**100**	

Table 3 shows a breakdown of the questionnaire administration table, a total of 286 questionnaire were administered to the respondents, 11 questionnaires or 4% were not returned by the respondents, 20 questionnaires or 7% were retuned, but was not usable due to mutilation, cancellation and error by the respondents at the point of filling the questionnaires, 255 questionnaires or 89% was actually retuned as usable and valid questionnaire, and this was used as the study sample.

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Table 4: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std. Error	Statistic	Std. Error
DEMOGRAPHIC	255	9.00	24.00	16.58	2.76	-.078	.122	-.213	.243
CUSTOMERSATISFACTION	255	73.00	129.00	107.19	10.43	-.458	.122	.048	.243
BILLINGPLATFORM	255	49.00	89.00	72.02	7.66	-.446	.122	-.026	.243
Valid N (listwise)	255								

The descriptive relates to the summarized variables for demographic data on; customer satisfaction and billing platform reveals that the total number of respondents for the study is 255 in all cases, missing data value is zero, with the mean statistics of [16.58; 107.19 and 72.02], and standard deviation of [2.76; 10.43 and 7.66] simultaneously. Skewness and Kurtosis in the study were used to assess the normality of the distribution of scores. Skewness value is used to determine the symmetry of the distribution ether positive or negative. The analysis as indicated on the graph for the study affirms a negatively skewed distribution as indicated on the descriptive statistics table. (-.078; -.458 and -.446).

Hypothesis One;

Implementation of operational policy framework has no effect on customer satisfaction in Nigerian energy sector.

Table 5. Correlations

		Customer Satisfaction	Billing Platform
Customer Satisfaction	Pearson Correlation	1.000	-.748**
	Sig. (2-tailed)		.000
	N	255	255
Billing Platform	Pearson Correlation	-.748**	1.000
	Sig. (2-tailed)	.000	
	N	255	255

**. Correlation is significant at the 0.01 level (2-tailed)

The outcome of the Pearson Correlations Coefficient is -.748 which affirms a negative connection between billing process and Customer Satisfaction (the higher the negative value of correlation Coefficient, the lower the level of customer satisfaction) in Nigeria Energy sector. The total number of cases as represented in the sample of the study is 255, the magnitude of the Pearson correlation (r), refers to the strength of the interrelationship between obsolete facilities and Customer Satisfaction. Hence, study with (r=–.748) shows that there is a large correlation between the two variables. The result obtained from the data analyzed showed a strong, negative correlation between the two variables [r=–.748, n=255, p<.0005].

Hypothesis Two;

Mismatched billing parameters have no effect on customer satisfaction in Nigerian energy sector.

Table 6. Correlations

		Customer Satisfaction	Billing Platform
Customer Satisfaction	Pearson Correlation	1.000	-.509**
	Sig. (2-tailed)		.000
	N	255	255
Billing Platform	Pearson Correlation	-.609**	1.000
	Sig. (2-tailed)	.000	
	N	255	255

**. Correlation is significant at the 0.01 level (2-tailed).

The result of the Pearson Correlations Coefficient is -.509 which asserts a negative interconnection between billing process and Customer Satisfaction (the higher the negative value of correlation Coefficient, the lower the level of customer satisfaction) in Nigeria Energy sector. The total number of cases as shown in the sample of the study is 255, the size of the Pearson correlation (r), relates to the strength of the relationship between non provision of prepaid meter and Customer Satisfaction. Hence, study with (r=–.509) shows that there is a large correlation between the two variables. The result obtained from the data analyzed showed a strong, negative correlation between the two variables [*r*=–.509, *n*=255, *p*<.0005].

Hypothesis Three;

Obsolete supply infrastructures have no effect on customer satisfaction in Nigerian energy sector.

Table7. Correlations

		Customer Satisfaction	Billing Platform
Customer Satisfaction	Pearson Correlation	1.000	-.711**
	Sig. (2-tailed)		.000
	N	255	255
Billing Platform	Pearson Correlation	-.711gap**	1.000
	Sig. (2-tailed)	.000	
	N	255	255

**. Correlation is significant at the 0.01 level (2-tailed).

The result of the Pearson Correlations Coefficient is -.509 which asserts a negative interconnection between billing process and Customer Satisfaction (the higher the negative value of correlation Coefficient, the lower the level of customer satisfaction) in Nigeria Energy sector. The total number of cases as shown in the sample of the study is 255, the size of the Pearson correlation (r), relates to the strength of the relationship between non provision of prepaid meter and Customer Satisfaction. Hence, study with (r=–.509) shows that there is a large correlation between the two variables. The result obtained from the data analyzed showed a strong, negative correlation between the two variables [*r*=–.509, *n*=255, *p*<.0005].

4. DISCUSSIONS OF FINDINGS

Here the collected main findings that were gathered from the analyzed with the connections made to the theory. the discussion of findings is to examine customer satisfaction on energy billing services in Nigeria. The key issues include: outcome of the null hypotheses, identified gaps in the research, Sustainability and economic development index are discussed as follows;

Hypothesis

Data collected and analyzed on the three null hypotheses shows that; there is a remarkable link between customer satisfaction and billing process in Nigerian energy sector. the Pearson Correlation Coefficient (r=–.748) reveals that, there is a large negative correlation between the variables due non-implementation of energy operational policy framework, with the following summaries [*r*=–.748, *n*=401, *p*<.0005].

Extrapolating for null hypothesis two, shows the relationship between the variables; mismatched billing parameters effect on Customer Satisfaction in Nigerian energy sector, the Pearson Correlation Coefficient (r=–.509). the outcome shows a negative interlink between the two variables, with the summaries [*r*=–.509, *n*=401, *p*<.0005].

The analysis for null hypothesis three, indicates the link between the variables; obsolete supply infrastructures effect on Customer Satisfaction in Nigerian energy sector, the Pearson Correlation Coefficient (r=–.711). the outcome shows a negative interconnection between the variables of the construct as summarized herein [*r*=–711, *n*=255, *p*<.0005].

In summary, based on the findings of the study on the outcome of null hypotheses one, two and three, the energy sector in Nigeria should make frantic effort, in implementing its robust operational policies, replace mismatched billing parameters and install state of the art supply infrastructures, to enhance transparency and accountability in service delivery. These to a large extent, will increase the level of customer satisfaction in the Nigerian energy sector.

Research Gaps

Several gaps have been identified in the course of the study, according to Miles. (2017), the following gaps have been identified to include;

Empirical or evaluation void gap: The study has unraveled a new dimension in evaluating customer experience in energy billing, based on expectation and actual service consumption experience (Paulin, et. al, 2016), and the adaptation of the disconfirmation maxim in customer perception of positive or negative disconfirmation, based on the outcome of service delivery experience (Ekinci & Sirakaya, 2004; & Anderson, 1998). The outstanding differential in this study is its attempt to fill the evaluation void gap in this field of study.

Theoretical/Contextual Gap: Existing literature has shown sketchy attempt in examining metering process in the south western part of the country, by examining a specific town (Adekitan, et. al, 2018), but the outstanding differential is that this study examines holistically the energy transition process nationally/globally, as well as identifying a state in the south-south region, to access energy billing process.

Methodological Gap: The methodology adapted in this study shows outstanding departure from previous studies, the systematic literature review (Coon, et.al, 2022; & Tsafnat, et. al, 2014); using PRISMA protocol is a clear attempt to adapted in this study is to close the gap in combination of diverse fields of study, in order to establish a solid conceptual basis for the study (Tricco, et al. 2018),

Sustainability

The devastating effect of carbon footprint and the ongoing effect of climate in our environment necessitates the convergence of global key players to transit from fossil fuel to cleaner energy processes, (Energy Data, 2018; United Nations, 2015a., United Nations, 2015b). This process does not attract the required implementation drive based on the fact that, about 600mMW of energy is being generated by households, public sector and firms for daily energy requirement; to fill the gap in energy generation (PHCN report, 2009). Hence, sustainable energy dream is still far from reach.

Economic Development Index

The key driver of industrial development globally is the availability of energy to drive GDP through, production, of goods and services, where there is a massive shortfall between energy demand and supply, developmental activities that could result in: improved standard of living, increase in per capita income, industrialization and kwh energy per capita could be hardly actualized (Okafor, 2008).

The central point to highlight here is that, DISCOS should make energy available to the end users due to inherited obsolete distribution facilities, inefficient and unprofessional workforce, lack of effective customer feedback procedure, inability of the regulatory authorities to enforce enabling legislation, bureaucratic bottlenecks and the hydra headed menace of corruption among stakeholders(employee, management, regulatory authorities and policy makers) , leading to a high level of frustration among its customers.

5. CONCLUSION AND RECOMMENDATIONS

The recommendation of this study is derived from the construct of the discussion of findings that, there is no relationship between obsolete transmitting facilities and customer satisfaction in Nigerian energy sector, and also, customer dissatisfaction due to non provision of pre-paid metering in Nigerian energy sector.

The study therefore recommends training and retraining programs for staff directly engaging with customers on all facet of the organization, replacement of all obsolete electrical equipment and facilities with technological best practice around the world, selection and motivation of well qualified professionals to handle both technical and administrative units of the organization, establishment of a robust and efficient customer feedback system to handle customer complaints and enquiries, holistic implementation of the signed Power Sector Roadmap 2010 by all stakeholders and, dismantling of all bureaucratic bottlenecks embedded in the process of obtaining prepaid meters by customers.

In the light of the highlighted gaps, i) prepaid customers must be pre-informed whenever the usage goes below authorized limit in order to recharge for guaranteed future usage. ii) prepaid meter helps the customers to be observant of possible unauthorized usage that could increase their billing. The system installed by the service provider constantly checks the customers' account, where the customer has credit, to ensure that the transmission and distribution components are at its optimal performance. The software also has the capacity to check energy theft through wire-tapping a legal customer line; In this case, offenders could be easily apprehended and prosecuted.

Hence, having examined the unjustifiable nature of the estimated billing platforms and its deterring effect on the end user, the researcher is of the opinion that, distributing the prepaid meter by the service provider could increase the level of customer's satisfaction in the Nigerian energy sector.

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Writing – review & editing: Mukhtar Abubakar, Oto Eshiett

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