Electricity theft in Nigeria: How effective are the existing laws?

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**Abstract** 

There is an overwhelming concern that if electricity theft is not controlled urgently, it will contribute immensely to a continued cycle of mountain debts and inefficiencies for not just the DISCOs but also for the GENCOs. There is an estimated average loss of about N21 billion annually in the power sector to energy theft. Against this backdrop, this paper provides a menu of options for the DISCOs in controlling electricity theft. In doing this, existing laws and regulations prohibiting energy theft in Nigeria and relevant empirical

literatures were duly reviewed. Cutting edge ideas on how to combat electricity theft were drawn from cross country experiences. Experience from the United Kingdom, United States of America and South Africa coupled with Nigeria's peculiarities informed the issues raised

for legislative consideration.

**Keywords:** *Electricity theft, existing laws, Nigeria.* 

1. Introduction

The privatization of the power sector in 2013 brought about the division of Power Holding

Company of Nigeria (PHCN) into three, namely; the Generating Companies (GENCOs),

Transmission Company of Nigeria (TCN) and the Distribution Companies (DISCOs). To

understand the extent of the detrimental effect of electricity theft on the power sector, the link

between the three and power efficiency, must be established. The GENCOs are responsible for

transforming hydro and gas power into electricity and transmit this electricity to the TCN; the TCN

uses their transmission grid to collect bulk electricity from the GENCOs and transmit to the

DISCOs; and the DISCOs buy electricity from the TCN and distributes to consumers for a price

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(tariff). While the GENCOs and DISCOs are privately owned, the TCN is owned and controlled by the Federal Government. 2

Privatizing the Power Sector was premised on the need for constant and adequate power, which is a pre-requisite for promoting industrialization and economic growth<sup>3</sup>. On this basis, the expectations from privatizing the power sector included an increased efficiency in the generation, transmission, and distribution and billing system. Ultimately, privatization was supposed to reduce the power sector infrastructure deficit and ensure efficient distribution.<sup>4</sup>

However, the expected benefits of privatization has been limited. The GENCOs average electricity generation stands at 3,000 MW compared to Nigeria's installed generating capacity of 10,396 MW. Limited access to foreign exchange as well as unfavourable exchange rate shocks are among the major threats to power generation.<sup>5</sup> For TCN, Nigeria's average electricity consumption per inhabitant is only 150 kWh per capita which is one of the lowest in the world<sup>6</sup>. High number of system collapses, inadequate manpower to ensure proper maintenance of transmission equipment, and the continuous vandalization of transmission equipment have contributed in the low electricity consumption per inhabitant.<sup>7</sup> Also, the DISCOs are in huge debt and are poorly funded. This is as a result of poor revenue collection framework and inefficient supply from the National Grid.<sup>8</sup>

<sup>&</sup>lt;sup>1</sup> M T Ladan, *Electricity Law, Policy and Reform implementation in Nigeria* (Zaria: Ahmadu Bello University Press Limited, 2014)

<sup>&</sup>lt;sup>2</sup> The Norton Rose Fulbright Publication July 2013 "Investing in the African electricity sector" <a href="http://www.nortonrosefulbright.com/knowledge/publications/100580/investing-in-the-african-electricity-sector">http://www.nortonrosefulbright.com/knowledge/publications/100580/investing-in-the-african-electricity-sector</a> Accessed 4 July 2018.

<sup>&</sup>lt;sup>3</sup> I O Joseph, "Issues and Challenges in the Privatized Power Sector in Nigeria" *Journal of Sustainable Development Studies*, Vol. 6(1).

<sup>&</sup>lt;sup>4</sup> Ibid.

<sup>&</sup>lt;sup>5</sup> B Oladejo, "Understanding the Nigerian Power Sector (GENCOS)" (2017)

<a href="http://sparkonline.com.ng/2017/01/understanding-the-nigerian-power-sector-gencos.html">http://sparkonline.com.ng/2017/01/understanding-the-nigerian-power-sector-gencos.html</a> Accessed 4 July 2018

<sup>&</sup>lt;sup>6</sup> B Oladejo, "Understanding the Nigerian Power Sector (TCN)" (2017)

<a href="http://sparkonline.com.ng/2017/01/understanding-the-nigerian-power-sector-tcn.html">http://sparkonline.com.ng/2017/01/understanding-the-nigerian-power-sector-tcn.html</a> Accessed 4 July 2018.

<sup>7</sup> Ibid.

<sup>&</sup>lt;sup>8</sup> *Ibid*.

Further, the Federal Government as well as the National assembly have both asserted that the privatization process has not worked as expected and agreed for the need for urgent actions in the power sector, which will involve the review of the privatization process. The Federal Government has undoubtedly taken vital steps in resuscitating the electricity sector – from privatisation, intervention funds, meter procurement, and investment in new power plants to mention a few; however there is still much needed improvement in the sector.

While there are other challenges confronting the power sector in Nigeria, Electricity theft confronting the DISCOs poses a great challenge. It is the criminal act of using electricity without paying for it; it includes but not limited to rigging an electricity line from the power source by bypassing the meter, unlawful direct connection to the distribution source, tampering with the meter for lower readings, billing irregularities by using employees of electricity companies and unpaid bills. The challenge of electricity theft therefore must be put into consideration to the needed improvements in the power sector as it will boost supply in the nation. This paper discusses the challenge of electricity theft in Nigeria, existing legal framework to curb the menace, makes comparative analysis with other jurisdictions on combating electricity theft and proffers recommendations for legislative consideration.

#### 2. Issues on Electricity Theft in Nigeria

Electricity theft is a serious problem to the entire value chain of the power sector.<sup>11</sup> Theft of electricity increases prices for customers and reduces safety. It leads to misallocation of costs among suppliers, which can distort competition and hamper the efficient functioning of market

The Guardian Newspaper 23 May 2018 <a href="https://guardian.ng/news/cpc-discos-seek-end-of-energy-theft-to-boost-power-supply-nationwide/">https://guardian.ng/news/cpc-discos-seek-end-of-energy-theft-to-boost-power-supply-nationwide/</a> Accessed 7 July 2018.

<sup>&</sup>lt;sup>9</sup> N Francis, "FG to Review Power Sector Privatization" This Day Newspaper October 13<sup>th</sup> 2017 <a href="https://www.thisdaylive.com/index.php/2017/10/13/fg-to-review-power-sector-privatisation/">https://www.thisdaylive.com/index.php/2017/10/13/fg-to-review-power-sector-privatisation/</a> Accessed 4 July 2018.

<sup>10</sup> R Okere, M Egbejule, I Akpan-Nsoh, "CPC, DISCOs seek end of energy theft to boost power supply nationwide"

<sup>&</sup>lt;sup>11</sup> A Adeniran, "Mitigating Electricity Theft in Nigeria" (2018) <a href="http://cpparesearch.org/nu-en-pl/mitigating-electricity-theft-nigeria/">http://cpparesearch.org/nu-en-pl/mitigating-electricity-theft-nigeria/</a> Accessed 7 July 2018.

operators.<sup>12</sup> When Electricity theft occurs, the cost of purchasing electricity from the GENCOs through TCN will be higher than the revenue collected from the sales of electricity to consumers. This is so because, electricity theft allows consumers to use electricity without paying for it. Electricity theft leaves the DISCOs with a huge liability. The DISCOs are unable to pay for electricity transmitted from the GENCOs, which makes them reject electricity while remaining indebted to the GENCOs.<sup>13</sup> In turn, this reduces revenues to the GENCOs while increasing the cost of generating electricity. The GENCOs cannot meet their obligations to gas suppliers, rendering them highly indebted with a reduced effectiveness in performing their primary function.<sup>14</sup> Electricity theft induces a cycle of indebtedness and ineffectiveness for both the DISCOs and GENCOs.

The occurrence of electricity theft has become dire. For instance, in 2014, the Ikeja Electricity Distribution Company (IKEDC) reported that 43,000 prepaid meters out of 134000 installed by the company have already been tampered with by their owners in a span of five years. Similarly, the Port Hacourt Electricity Distribution Company (PHED) in 2017 reported a loss of about 30% of expected revenue to energy theft. The distribution company noted that energy theft represented a huge revenue leakage to the company. Also, the Enugu Electricity Distribution Company (EEDC) reported a loss of about 43% of its expected monthly revenue to energy theft. Further,

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<sup>&</sup>lt;sup>12</sup> H N Amadi, E N C Okafor, F I Izuegbunam, "Assessment of Energy Losses and Cost Implications in the Nigerian Distribution Network" (2016) *American Journal of Electrical and Electronic Engineering*, Vol. 4, No. 5. <sup>13</sup> *Ibid*.

<sup>&</sup>lt;sup>14</sup> *Ibid*.

<sup>&</sup>lt;sup>15</sup>The Ikeja Electricity Distribution Company (IKEDC) June 10<sup>th</sup> 2014 "43,000 Installed Prepaid Meters Already Tampered With" http://www.nigeriaelectricityhub.com/tag/electricity-theft/ Accessed 8 July 2018.

<sup>&</sup>lt;sup>16</sup> S Daniel, "Energy theft: PHED moves against perpetrators" The Vanguard Newspaper 31<sup>st</sup> August 2017 https://www.vanguardngr.com/2017/08/energy-theft-phed-moves-perpetrators/ Accessed 8 July 2018.

<sup>&</sup>lt;sup>17</sup> E Uzodinma, "Energy Theft: EEDC introduces whistle blowing" The Daily Post October 6<sup>th</sup> 2017 <a href="http://dailypost.ng/2017/10/06/energy-theft-eedc-introduces-whistle-blowing/">http://dailypost.ng/2017/10/06/energy-theft-eedc-introduces-whistle-blowing/</a> Accessed 8 July 2018.

more recently, the Eko Electricity Distribution Company (EKEDC) reported that it was losing over 
№1.2 billion monthly to energy theft and commercial losses in its network.<sup>18</sup>

#### 2.1 Existing Laws and Regulations Prohibiting Energy Theft in Nigeria

The Nigerian Legal system makes provision for the prohibition of electricity theft and also imposes penalties for perpetrators of the offence. Thus Section 94 (3) of the Electric Power Sector Reform Act (EPSRA) 2005 provides that 'Notwithstanding anything contained in any other law, any person who wilfully destroys, injures or removes equipment or apparatus of a licensee commits an offence and is liable on conviction to imprisonment for a period of not less than five (5) years and not more than seven (7) years.<sup>19</sup>

The Miscellaneous Offences Act (MOA)<sup>20</sup> also consists of provisions dealing with tampering with electrical equipment's. Section 1(9) of the MOA provides that "any person who unlawfully disconnects, removes, damages, tampers, meddles with or in any way whatsoever interferes with any plant, works, cables, wire or assembly of wires designed or used for transforming or converting electricity shall be guilty of an offense and liable on conviction to be sentenced to imprisonment for life". Section 1(10) of the MOA additionally provides that "any person who unlawfully disconnects, removes, damages, tampers, meddles with or in any way whatsoever interferes with any electric fittings, meters or other appliances used for generating, transforming, converting, conveyancing, supplying or selling electricity shall be guilty of an offence and liable on conviction to imprisonment for a term not exceeding 21 years."

<sup>18</sup> PM NEWS Nigeria February 22<sup>nd</sup> 2018 "Electricity theft: Eko Disco loses N1.2 billion monthly" <a href="https://www.pmnewsnigeria.com/2018/02/22/electricity-theft-eko-disco-loses-n1-2-billion-monthly/">https://www.pmnewsnigeria.com/2018/02/22/electricity-theft-eko-disco-loses-n1-2-billion-monthly/</a> Accessed 8 July 2018.

<sup>&</sup>lt;sup>19</sup> Electric Power Sector Reform Act No. 6, 2005.

<sup>&</sup>lt;sup>20</sup> Miscellaneous Offences Act CAP M17 Laws of the Federation of Nigeria 2004.

Additionally, pursuant to section 96(2) of the EPSRA 2005 which confers power to make regulations on the Nigerian Electricity Regulatory Commission (NERC), the NERC has made several regulations, of particular importance is the regulation to deter the theft of electricity, theft and destruction of electricity supply infrastructure, and penalties for such theft and or destruction for electricity offences theft and Other Related Offences Regulations (2014).

The NERC Theft and Other Related Regulations, 2014<sup>21</sup> provides in Regulation 1 that, "any person who wilfully and unlawfully (a) taps, makes or causes to be made any connection with overhead, underground or - under water lines or cables, or service wires, or service facilities of a licensee, or (b) tampers with a meter, installs or uses a tampered meter, current reversing transformer, shorting or shunting wire, loop connection, receives electricity supply by by-passing a meter, or uses any other device or method which interferes with accurate or proper registration, calibration or metering of electric current or otherwise results in diversion in a manner whereby electricity is stolen or wasted; or (c) damages or destroys an electric meter, apparatus, equipment, wire or conduit or causes or allows any of them to be so damaged or destroyed as to interfere with the proper or accurate metering of electricity, so as to abstract or consume electricity or knowingly use or receive the direct benefit of electric service through any of the acts mentioned in paragraphs (a), (b) and (c) or uses electricity for the purpose other than for which the usage of electricity was authorized, so as to abstract or consume or use electricity shall be guilty of an offence under Sections 383 and 400 of the Criminal Code, Sections 286 (2) of the Penal Code and Section 1 of this Regulation, and shall be punishable with terms of imprisonment as applicable, provided under Sections 390 of the Criminal Code, Section 287 of the Penal Code or Section 94 of the EPSR Act."

<sup>&</sup>lt;sup>21</sup> Electric Power Sector Reform Act (No. 6 Of 2005) Regulations to deter the Theft of Electricity, Theft and Destruction of Electricity Supply Infrastructure, and Penalties for such Theft and or Destruction for Electricity Offences.

### 3. Brief review of empirical literature

According to Smith<sup>22</sup> electricity theft can be in the form of fraud (meter tampering), stealing (illegal connections), billing irregularities, and unpaid bills. The study undertook estimates of the extent of electricity theft using a sample of 102 countries for 1980 and 2000. The results showed that theft is increasing in most regions of the world. The financial impacts of theft are, reduced income from the sale of electricity and to charge more to consumers. The study revealed that electricity theft is closely related to governance indicators, with higher levels of theft in countries without effective accountability, political instability, low government effectiveness and high levels of corruption.<sup>23</sup> The study further therefore recommended that electricity theft can be reduced by applying technical solutions such as tamper-proof meters, managerial methods such as inspection and monitoring, and in some cases restructuring power systems ownership and regulation.<sup>24</sup> Utilizing data from the power corporation of Uttar Pradesh, India's most populous state, Golden, and Min<sup>25</sup> studied the politics of electricity theft over a ten year period (2000-09). Their results showed that electricity theft is substantial in magnitude and that the extent of theft varies with electoral cycle of the state. They also found that in the years when elections to the State Assembly are held, electricity theft is significantly greater compared to the non-election years. Theft is increasing with the intensity of tube wells, suggesting that it is linked to unmetered electricity use by farmers. Incumbent legislative members of the state assembly are more likely to be re-elected as power theft in their locality increases. <sup>26</sup> Their interpretation of the various results was that power

<sup>&</sup>lt;sup>22</sup> T B Smith, "Electricity theft: a comparative analysis" (2004) Energy Policy 32, 2067–2076.

 $<sup>^{23}</sup>$  Ibid.

<sup>&</sup>lt;sup>24</sup> Ibid.

<sup>&</sup>lt;sup>25</sup> M Golden and B Min, "Theft and Loss of Electricity in an Indian State" Paper presented at the 2011 Annual Meetings of the American Political Science Association September 2–5, Seattle and at the 2nd IGC-ISI India Development Policy Conference, December 19–20, 2011, ISI Delhi Center. <a href="https://www.theigc.org/wp-content/uploads/2014/09/Golden-Min-2012-Working-Paper.pdf">https://www.theigc.org/wp-content/uploads/2014/09/Golden-Min-2012-Working-Paper.pdf</a> Accessed 16 July 2018.

theft exhibits characteristics consistent with the political capture of public service delivery by local elites.<sup>27</sup> Their results however fail to substantiate that theft is linked either to political criminality or is the product of weak institutions.

Nielsen<sup>28</sup> found that illegal electricity usage has a positive correlation with rate of illiteracy and regular events of violence, such as terrorism. According to the study, if the illiteracy rate and terrorist events in a region or city are higher, illegal electricity usage is expected to be higher because high illiteracy and terrorism usually indicate low income in that region or city. Investments to a city or region are discouraged due to insecurity. This finding was corroborated by Steadman<sup>29</sup> who discovered that regions with higher murder rates and lower household incomes are using more illegal electricity.

Jamil and Ahmad<sup>30</sup> acknowledged that electricity theft is a common problem in many countries and that energy worth billions of dollars is stolen annually from electricity grids. According to the authors, the problem has socioeconomic, political, environmental and technical roots, but the solution is generally sought solely through technical. In the light of the foregoing, they empirically investigated the effects of various factors including electricity price, per capita income, probability of detection, fines collected from offenders, weighted temperature index and load shedding, that may explain electricity theft.<sup>31</sup> The study employed annual panel data obtained from nine electricity distribution companies in Pakistan for the period 1988–2010. The study estimates the Fixed Effects models through the Least Squares Dummy Variable (LSDV) technique and

<sup>&</sup>lt;sup>27</sup> *Ibid*.

<sup>&</sup>lt;sup>28</sup> S Nielsen, "Smart Meters Help Brazil Zap Electricity Theft" (2012) <a href="http://www.businessweek.com/articles/2012-03-08/smart-meters-help-brazil-zapelectricity-theft">http://www.businessweek.com/articles/2012-03-08/smart-meters-help-brazil-zapelectricity-theft</a>. Accessed 16 July 2018.

<sup>&</sup>lt;sup>29</sup> K Steadman, "Electricity Theft in Jamaica" PhD dissertation, State University of New York at Binghamton. (1999) http://www.academia.edu/1566775/Electricity Theft in Jamaica Accessed 16 July 2018.

<sup>&</sup>lt;sup>30</sup> F Jamil, E Ahmad, "An Empirical Study of Electricity Theft from Electricity Distribution Companies in Pakistan" (2014) *The Pakistan Development Review*, Vol 53:3.

<sup>31</sup> *Ibid*.

Generalised Method of Moments (GMM). The results indicated that per capita income has significant negative and electricity price a positive effect on electricity theft with sufficiently high coefficient values. The probability of detection variable appears with a positive sign in both estimations indicating a poor deterrence. The results of LSDV showed a positive impact of fine on conviction on electricity theft. But in GMM estimation, this variable appears with a right sign. The results from both models were robust in the case of load shedding and temperature variables. The findings showed that economic variables are most significant in explaining electricity theft. Jumale,  $et al^{32}$  in a study for India found that electricity distribution authorities loose a large chunk of income, due to illegal connections or dishonesty of customers for their personal gains. According to the authors, various systems are introduced by researchers to detect the theft and diminish the non-operational loses. The methods like Support Vector Machine (SVM), Fuzzy Cmeans Clustering, Fuzzy logic, User profiling, Genetic Algorithm, among others, are used to detect theft in electricity. The authors noted that two disadvantages associated with using these systems based on this methodologies is accuracy and also the infrastructure needed to employ them (like smart energy meter). They proposed new system which tries to enhance the accuracy of theft detection.

# 4. Comparative analysis with other Jurisdictions on Combating Electricity Theft

Country	Legislation	Method of Combating
		<b>Electricity Theft</b>
United	Section 13 of the Theft Act, 1968 provides for	- Confidential reports by
Kingdom	Abstracting Electricity, which is a statutory offence in	citizens.

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<sup>&</sup>lt;sup>32</sup> P Jumale, A Khaire, H Jadhawar, S Awathare, and M Mali, "Survey: Electricity Theft Detection Technique" (2016) *International Journal of Computer Engineering and Information Technology*, Vol 8, No. 2.

	the UK. It provides that a person who dishonestly uses	- Use of Smart Meters for
	without due authority or dishonestly causes to be	billing as well as at distribution
	wasted or diverted any electricity on conviction or	points in order to ensure
	indictment be liable to imprisonment for a term not	electricity balancing analysis.
	exceeding five years.	(AMI technology)
		- Training and Education
		- TRAS: Electricity Theft Tip-
		Off Service – ETTOS
		- Artificial Intelligence and
		Machine Learning methods <sup>33</sup> .
United	The laws on theft differ among states. For example,	- Meter readers need training to
States of	the state of Louisiana (2006 Louisiana Laws - RS	quickly review each meter and
America	14:67.6 — Theft of utility service; inference of	socket for signs of tampering,
	commission of theft; penalties), provides as follows-	removal and other
	"C(1) On a first conviction, the offender shall be fined	irregularities.
	not less than one hundred dollars nor more than five	- Along with educating the
	hundred dollars or imprisoned for not more than six	paying public, utilities provide
	months, or both.	a secure web portal and
	(2) On a second or subsequent conviction, regardless	confidential toll-free phone
	of whether the second or subsequent offense occurred	number for customers to report
	before or after an earlier conviction, the offender shall	suspected energy theft.
	be fined not less than one hundred dollars nor more	
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<sup>&</sup>lt;sup>33</sup> TRAS: Theft Risk Assessment Service <a href="https://www.electralink.co.uk/services/governance-management/theft-risk-assessment-service/">https://www.electralink.co.uk/services/governance-management/theft-risk-assessment-service/</a> Accessed 16 July 2018.

Reporting through the internet
remain anonymous. Utilities
rovide a secure web portal and
onfidential toll-free phone
umber for customers to report
spected energy theft.
Use of AMI technology.
Special meter locks are
stalled to prevent meter
moval for those previously
hught or suspected of energy
eft. Transparent socket
overs deters tampering also <sup>35</sup>
Install prepaid meters in
andal-proof boxes to avoid
ser interference and
mpering;
Encourage report of illegal
ectricity connections; <sup>37</sup>
s s mu e

<sup>&</sup>lt;sup>34</sup> 2006 Louisiana Laws - RS 14:67.6 — Theft of utility service; inference of commission of theft; penalties https://law.justia.com/codes/louisiana/2006/146/78623.html Accessed 17 July 2018.

<sup>&</sup>lt;sup>35</sup> S Eckles, S Clark, El Paso Electric Company, "Pulling the Plug on Energy Theft" (2007) http://www.elp.com/articles/powergrid international/print/volume-12/issue-9/features/pulling-the-plug-on-energytheft.html Accessed 17 July 2018.

<sup>&</sup>lt;sup>36</sup> Notice 1610 of 1999, Greater Johannesburg Metropolitan Council Standardisation of Electricity By-Laws

https://joburg.org.za/bylaws/electricity\_bylaws.pdf\_Accessed 17 July 2018.

37 ESI Africa August 25 2017 "Combating crime remains an ongoing reality for SA power utility" https://www.esiafrica.com/combating-crime-remains-reality-sa-power-utility/ Accessed 17 July 2018.

- (a) shall be charged, in respect of the current meter reading period, the same amount as the consumer has paid in respect of the corresponding period in the preceding year subject to the adjustment necessitated by any alteration to the electrical installation or the charge determined by the council; or
- (b) if the consumer was not in occupation of the premises during the corresponding period referred to in paragraph (a), shall be charged on the basis of his consumption during the three months preceding the last date on which the meter was found to be registering correctly; or
- (c) if the consumer was not in occupation of the premises during the whole of the period referred to in paragraph (b), shall be charged on the basis of his consumption during the three months following the date from which the meter was again registering correctly.
- (2) If it can be established that the meter has been registering incorrectly for a longer period than the meter reading period referred to in sub clause (1), the

- Targeting these neighbourhoods with load shedding;
- Operation Khanyisa

  Campaign to combat electricity

  theft and mobilise South

  Africans to use power legally;<sup>38</sup>
- Extended penalties to the owners of any property where electricity theft occurs.

<sup>&</sup>lt;sup>38</sup> M Rycroft, "Operation Khanyisa" (2013) *ee publishers*, <a href="http://www.ee.co.za/article/operation-khanyisa-352-03-interview-with-maboe-maphaka-operation-khanyisa.html">http://www.ee.co.za/article/operation-khanyisa-352-03-interview-with-maboe-maphaka-operation-khanyisa.html</a> Accessed 18 July 2018; ESI Africa October 16 2018 "Operation Khanyisa is paying off" <a href="https://www.esi-africa.com/operation-khanyisa-paying-off/">https://www.esi-africa.com/operation-khanyisa-paying-off/</a> Accessed 17 July 2018.

consumer may be charged with the amount
determined in accordance with the said subsection or
for a longer period:

Provided that no amount shall be so charged in respect
of a period in excess of 38 months prior to the date on
which the meter was found to be registering
incorrectly.

## 5. Conclusions and issues for legislative consideration

Borrowing from the UK, this study recommends confidential reporting by citizens. The already existing whistle blowing policy of the Federal government should be extended to energy theft. Accordingly, ideals should be borrowed from the USA to the extent that along with educating the paying public, a secure web portal and confidential toll-free phone number should be provided for customers to report suspected perpetrators of energy theft.

Further, there should also be an increased liability for owners of property where electricity theft occurs. This will pass some burden of monitoring from the DISCOs to the owners of such property. The property owners will ensure that electricity theft does not occur, in order not to bear any form of loss through fines nor imprisonment. On this basis, this study recommends that the Electric Power Sector Reform Act 2005 be amended to reflect these measures, to serve as a deterrent aimed at mitigating electricity theft in Nigeria.

In addition, for consumers who are meter billed, the use of AMR meters should discontinued, as this will aid in combating electricity theft. AMR meters do not allow for a two way communications between the DISCOs and the consumer,<sup>39</sup> consequently, when they are tampered with, there are time lags between when the tampering occurred and when the DISCOs become aware of it.<sup>40</sup> As an alternative, this study proffers recommendation for the installation of Smart meters (an example is the Open Smart Grid Protocol (OSGP) commonly used in Europe or Elster REX mesh network reading and time-of-use meters commonly used in the USA). These smart meters allow for the recording of electricity consumption on an hourly basis and relate same to the DISCOs for monitoring.<sup>41</sup>

Accordingly, the instalment of Smart meters with AMI technology should not be restricted to consumer locations only. They should also be installed at distribution and sub – distribution (small transformers and larger (grid) transformers) points. The essence of this is to allow for efficient monitoring and balancing of distributed electricity from the DISCOs and reported electricity consumption from the consumers. With any difference, it will be easy to detect electricity theft and localise where the theft has occurred.

On the other hand, given that a large proportion of electricity consumers are unmetered, the DISCOs should increase their efforts in monitoring electricity consumption. There should be a collaboration between DISCOs and the NERC, to establish a joint task force with the sole responsibility of monitoring illegal connections and meter tampering; also at the end of every month, when consumer electricity bills are being delivered for unmetered consumers, the task force should investigate for all forms of electricity theft, and ensure that perpetrators are punished for their offences. Further, this study recommends for random walk-ins by officials of the DISCOs, to

<sup>&</sup>lt;sup>39</sup> N Uribe-Pérez, L Hernández, D de la Vega, Itziar Angulo, "State of the Art and Trends Review of Smart Metering in Electricity Grids" (2016) *Applied Sciences* Vol 6(68).

<sup>&</sup>lt;sup>41</sup> A Yvs, "Smart Meter" <a href="https://www.scribd.com/document/281793525/Smart-Meter">https://www.scribd.com/document/281793525/Smart-Meter</a> Accessed 17 July 2018.

carry out inspection checks for metered consumers, as this will aid in combating widespread electricity theft in Nigeria.