



**CONCEPT PAPER ON CAPPING ESTIMATION OF ENERGY CONSUMPTION
DEVELOPED BY THE NIGERIAN ELECTRICITY REGULATORY COMMISSION (NERC)**

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1. Background

Metering is a critical component of the business of electricity. It serves as the only parameter for quantifying energy delivered and energy utilized by the supplier and consumer respectively. It is therefore imperative that every electricity consumer is effectively metered at the expense of the DISCO to enable fair and transparent billing to take place.

Condition 41(2) of the Distribution License Terms and Condition envisaged that operational meters should first be installed before connection. It stipulates that: ***“ Electricity supply to a customer should be effected with an operational meter first being installed”***. Section (1) of the regulation on connection and DISCO connection procedures stipulates that ... a distribution company shall fit meter and connect electricity supply in line with the Commission’s customer service standards of performance”.

Condition 41(6) further states that: *“The Licensee shall be responsible for installing electrical energy meters at its own expense and shall be the owner of all installed metering equipment. If malfunction or damage occurs to the meter for any reason that is out of the customer’s control, the Licensee shall repair the damage/malfunction or change the meter as quickly as possible, at its own expense”*.

Section 1(1) of the Meter Reading, Billing, cash Collection and Credit Management Regulation provide guidance on why and how estimation should be done.

2. Metering in the NESI: Current Status

In 2012 the Commission set up a Public Review Committee on Metering situation in the NESI. The Committee held discussion with consumers, operators and stakeholders in all regions of the country and it was discovered that the position of metering was unsatisfactory . The situation has not improved as there is still an abysmally low level of metering in the NESI. As at today, over 50% of all the registered customers are either unmetered or have nonfunctional meters as shown in the table 1. below.

Table 1:Percentage of customer population that are unmetered in the NESI

S/N	Distribution Company	Percentage of unmetered Customers
1	Abuja	55.00%
2	Benin	61.2%
3	Eko	51.82%
4	Enugu	55.16%
5	Ibadan	43.00%
6	Ikeja	53.64%
7	Jos	39.86%
8	Kaduna	65.02%
9	Kano	53.64%
10	Port Harcourt	76.94%
11	Yola	51.31%
Average		53.66%

Source: DISCOs metering plan presentation to NERC (2015)

In cognizance of the situation, the Commission came up with a number of initiatives to address this metering gap. Notably,

- 1 Commitment was obtained from the Distribution Companies (DISCOs) for the implementation of an 18-month phased metering plan to bridge the metering gap
2. Introduction of the Credited Advance Program for Metering Implementation (CAPMI) to overcome the problem of lack of funds in dealing with the metering gap.

3. Generous financial provisions included in the Operating and Capital expenditure budget of the DISCOs in MYTO2 for meter roll out.

The above initiatives did not yield the desired result as the implementation were poorly executed with minimal roll-out of meters recorded in all the DISCOs in spite of provisions for full cost recovery. The Commission recently discovered that in some instances, the Distribution Companies blatantly refused to meter their customers as evidently seen from the metering plans presented. That a DISCO installed only 32 meters from the handover (November 1st, 2013) to date is unacceptable.

Of particular significance is the CAPMI Scheme which suffered poor implementation in spite of customers' willingness to make advance payments for meters. Although customers paid for meters, some of the DISCOs did not provide meters as expected to those who paid and others failed to make adjustment in their billing software to make the mandatory refunds, six months after installation of the CAPMI meters.

In view of the above, an option worth considering to incentivizing metering is to place a limit on the ability of a DISCO to arbitrarily estimate consumers who are not metered. This has the tendency of encouraging DISCOs to accelerate the implementation of metering plans that have been talked about but not implemented since before privatization and after taking over the management of the DISCOs.

3. Consequences of Non-Metering

Consequent upon the above situation, the market has suffered high incidences of revenue loss in the form of:

- Customers who continue to contest arbitrary bills.
- Customers who are reluctant to pay for what they call "crazy bills" and sometimes resort to outright power theft.
- Customers unwillingness to embrace energy efficiency and conservation.

Furthermore, the Commission came up with a methodology for estimated billing to ensure objectivity in the determination of estimated bills for unmetered consumption in line with section 1(5) of the Meter Reading, Billing, Cash Collection and Credit Management Regulation. The methodology was based on cluster average approach whereby unmetered customers within the same cluster receive bills similar to their metered counterparts on the same feeder with minimal variance. This estimation methodology required that the DISCOs have their energy supply metered at least up to the 11kV feeder such that energy balance is achieved at each feeder level taking into consideration the variation in the energy supplied to the feeders each month.

This intervention has also not yielded the desired result as the Distribution Companies have failed to implement the methodology citing their inability to deploy energy meters even at feeder levels as the main constraint.

While all these efforts at accelerated metering had proved abortive, the customers still groan under high estimated billing that are often not related to the level of energy supplied. Some of the DISCOs simply deduct the metered consumptions from the energy received and then distribute the balance of energy among the unmetered consumers arbitrarily. Sometimes such apportionment is unrelated to the level of energy supplied to the feeder during the month, so the consumers on such feeder complain of receiving “outrageous bills”.

The Commission has had cause to take enforcement actions against some operators over such arbitrary and outrageous estimation of energy consumed by their customers.

It has now become evident that the incentive for non-metering by the DISCOs is the practice of unregulated estimation which puts undue financial hardship on the customers. This is mainly because the DISCOs are able to make-up their revenue by assigning arbitrary energy consumption estimates to unmetered customers and thus they have no incentive to urgently conduct proper customer enumeration and detect illegal consumers who engage

in power theft nor the incentive to invest in metering those already captured in their billing system.

The mandate of the Commission is to protect not only the operators but also the customers. It is therefore imperative on the Commission to place the burden on the operators who *ab initio* have the responsibility to meter their *customer* in view of Section(1) of the regulation on connection and disconnection procedures.

The Commission is fully aware that the new owners have contractual obligations under the Privatization programme to meter all their customers within five years. They however have a concurrent and immediate regulatory obligation by virtue of their licensing terms and conditions to not only meter but also to ensure fair treatment to all their customers.

4. Capping of Estimation

In view of the issues discussed in (2) and (3) above, the Commission should initiate a scheme that can:

1. control the issuing of “crazy and excessive bills” to customers,
2. incentivize the metering of the customers by the DISCOs and
3. ensure that the financial viability of the industry is not threatened.

This can be achieved by setting a ceiling or cap on the amount of energy consumption that unmetered customers in a particular tariff class can be billed by estimation in a particular month.

The ideal cap should be such that it is close enough to the average consumption of metered consumers so that it will not serve as an incentive to customers to resist metering and low enough to create some sort of revenue shortfall relative to what would be realized if these customers were all metered. This initiative would incentivize the Distribution Companies to accelerate the metering of any customer whose consumption is capped (i.e. who is unmetered) in order to gain an increase in their revenue collection. The shortfalls should represent financial incentive for the DISCO to meter their customers in the shortest possible timeframe.

It is also recognized that no capped amount is fair to all customers. Hence customers who believe their consumption falls below the cap can avail themselves of the CAPMI scheme to get metered immediately and receive refunds for the cost of the meters over a period of time. In the event that any such customer chooses to be metered under the CAPMI scheme but the DISCO fails to provide the meter within the period stipulated in the CAMPI regulation, the DISCO will be adjudged to have breached one of its licensing terms and conditions as quoted above. The Commission shall then impose appropriate regulatory sanctions; including losing the right to bill the customer in subsequent months until a functional meter is installed.

The Commission have choose to issue an Order setting the cap but with an effective implementation date after a moratorium of 4 months to allow the Distribution Companies to appropriately adjust their metering program. All estimates being imposed by DISCOs within the moratorium period shall be strictly based on the Commission Billing Estimation Methodology. As soon as the capping regulation commences, the extant regulation on estimation methodology will be vacated and DisCos are expected to meter all unmetered customers within the period of two (2) Years from the start date.

5. Framework for Capping Estimation

In determining the basis for setting a cap for the estimation of the electricity bills of customers, a number of option/models can be adopted namely:

1. Capping by building size: This implies giving estimates according to the size of the consumer building. The weakness of this option is that energy consumption depends on the ratings of appliances operated and the hours of supply rather than the size of the building.
2. Capping by amount to be paid per month: This will require fixing certain monetary limit that unmetered consumers may be charged each month but since electricity retail tariff differ from DISCO to DISCO and from year to year, the unit of energy that can be purchased by the same amount will differ by DISCO.

3. Capping by Tariff class and energy consumption pattern: This entails looking at each tariff class and determining their typical monthly consumption. The merit of this option is that credible historical energy consumption by metered customers, obtained from the DISCOs, is available for every tariff class and can be used to determine an average amount for energy consumption for any particular class across all the DISCOs.

After looking at the merits and demerits of each model and based on the availability of the required data, the third option i.e. the Capping by Tariff class and energy consumption pattern was adopted.

Modality for Capping Based on Customer Energy Consumption and Customer Class.

In setting a cap for energy consumption for these categories of electricity consumers, the following study reports were considered:

- i. Report of spot household energy survey conducted by Energy Commission of Nigeria in 2005. The spot survey was used to determine energy consumption by various classes of industrial, commercial and residential energy users as part of their energy demand modeling activities. Survey was conducted in four states by Japan International Cooperation Agency (JICA) in 2006 for preparation of solar energy master plan for Nigeria.
- ii. Report of National Load Demand study conducted in 2009 by Tractebel Engineering.
- iii. Report of UNDP-GEF in 2012 spot survey of residential energy consumption conducted to establish baseline data for energy efficiency labeling standard activities.
- iv. Report of survey of energy consumption by R1 and R2 classes of electricity consumers conducted by NERC consultants in 2014 towards determining the implication of the establishing Power Consumers Assistance Fund (PCAF).

- v. Four months meter reading records submitted by the Distribution Companies in 2015 to NERC.
- vi. Customer consumption profile of the various classes as contained in the MYTO Model for DISCOs

Furthermore, a breakdown of the data submitted by four (4) DISCOs indicate that, their data was obtained from a total 42,153 credit meters (consisting of 585 meters of A1 tariff class, 6000 meters of C1 tariff class and 35,568 meters of R2 tariff class of customers). This data was analysed to determine the pattern of consumption among the target customer classes; A1, C1, and R2 as they were considered as the more vulnerable classes of customers.

6. Setting the Cap and the Impact Analysis:

An analysis of the normal distribution curve of the Tariff classes, A1, C1, and R2 was used to establish the modal range of average monthly energy consumption (kWh) for each of the three classes are as follows:

A1: 201 to 250 kWh/Month

C1: 151 to 200 kWh/Month

R2: 151 to 200 kWh/Month

7. Impact Analysis

Figure 1. show the normal distributiion chart of R2 customer population with ranges of energy consumptiion.

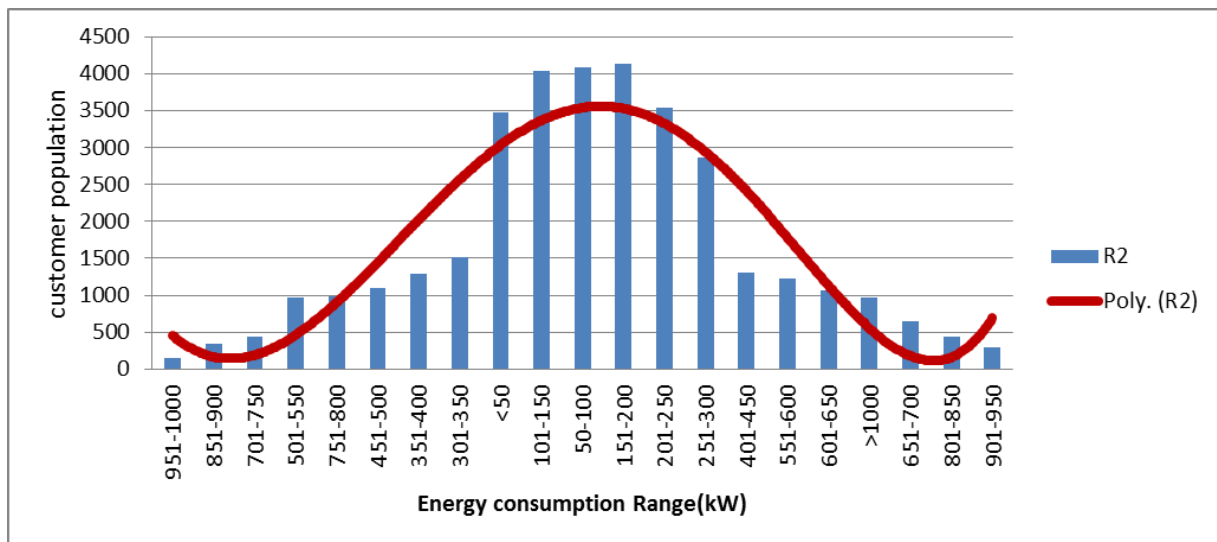


Figure 1: Distribution of customer Population with Energy Consumption Ranges

A further analysis shows that 43.6% of the population consume less than 200 units while 32.8% consume less than 150 units. The implication of this is that a cap of 200 units will put 43.6% of unmetered customers in this class at the risk of paying more than their actual consumption i.e. they will be overbilled while setting a cap of 150 units, will mean 32.8% of unmetered customers in this class are at the risk of being over billed. Hence 150 units is adopted as the cap or maximum billable amount of monthly energy consumption (in units) for this tariff class.

Impact of Capping R2 at 125 kWh/month

The MYTO 2.1(amended) Order put the population of R2 customers at 7,026,573 with an annual consumption of 9,398,263,687kWh or a customer average of 112kWh/month.

Based on the current metering gap figures submitted by the DISCOs, 53.66% of their registered customers are unmetered. Hence population of unmetered R2 customer = 53.66% of 7,026,573 = 3, 770, 459

The said Order also puts expected industry revenue from R2 customers as =N=209.457 billion. Thus with the current metering level, the expected revenue from unmetered customers is =N=112.395 billion (i.e. 53.66% of =N=209.457 billion)

If all the unmetered R2 customers are billed at the capped amount, the industry revenue from the unmetered R2 customers will be:

= population of unmetered R2 customer X annual average energy charge* based on the R2 cap.

*The average energy charge is derived from Table 3 below:

i.e. = 3, 770, 459 X 2355.8 X 12 = N106.590 billion

Therefore the projected revenue shortfall of capping R2 is N112.395Billion - N106.590 Billion = =N=5.805Billion

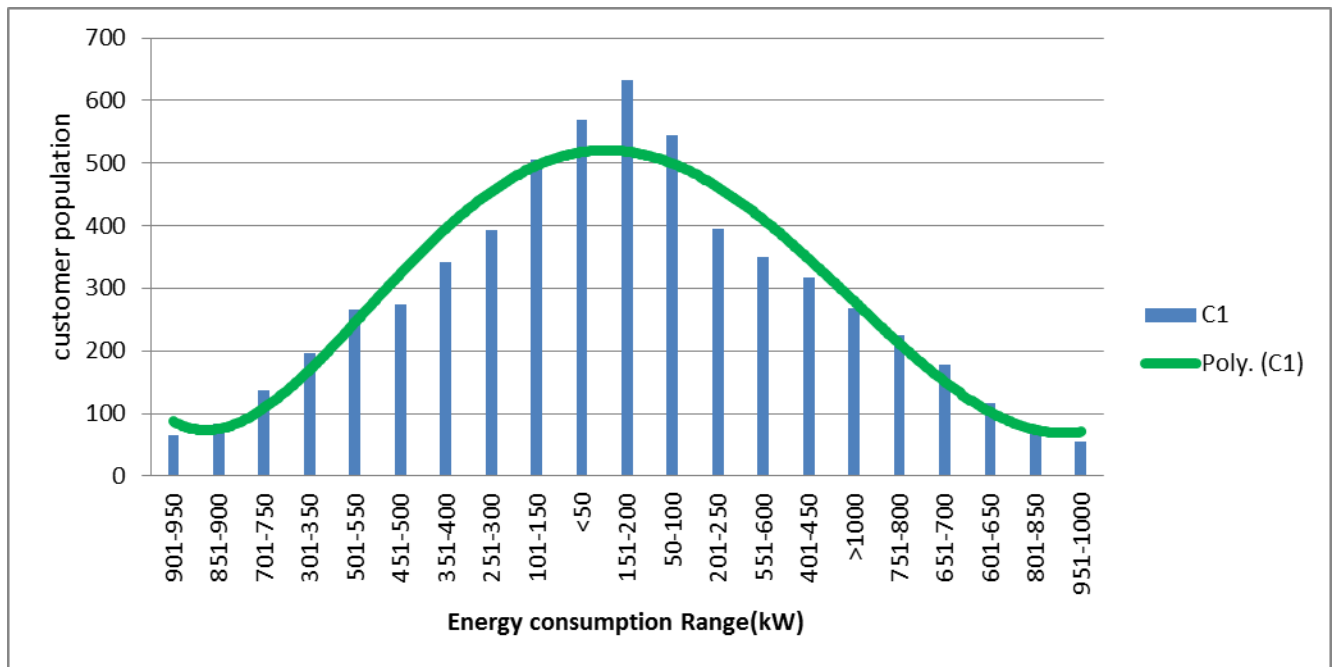


Figure 2: Distribution of C1 customer population with Energy Consumption Ranges

The modal range in the above distribution is the range 151-200. A further analysis shows that

54.7% of the population consume less than 200 units while 40.41% consume less than 150 units. The implication is that a cap of 200 will put 54.7% of unmetered customers in this class at the risk of paying more than their actual consumption. If we adopt 150 units, only 40.41% of unmetered customers in this class are at the risk of over billing. Hence to further reduce the error level, 125 units is adopted as the cap for this class.

Impact of Capping C1 at 125 kWh/month

The MYTO 2.1(amended) Order put the population of C1 customers at 1,271,979 with an annual consumption of 1,811,695,701 kWh or a customer average of 119 kWh/month.

Based on the current metering gap analysis submitted by the DISCOs, 53.66% of their registered customers are unmetered. Hence population of unmetered C1 customer = 53.66% of 1,271,979 = 682,544

The order also puts expected industry revenue from C1 customers as N 49.056Billion hence at the current metering level, the expected revenue from unmetered customers (53.66% of 49.056 Billion) =N 26.324 Billion .

If all the unmetered C1 customers are billed at the capped amount, the industry revenue from the unmetered C1 customers will be population of unmetered C1 customer x average energy charge based on the C1 cap x 12. i.e $682544 \times 2725.0 \times 12 = 22.319$ Billion

Industry revenue impact of capping C1 is N 26.324 Billion – N 22.319 Billion = N4.004Billion

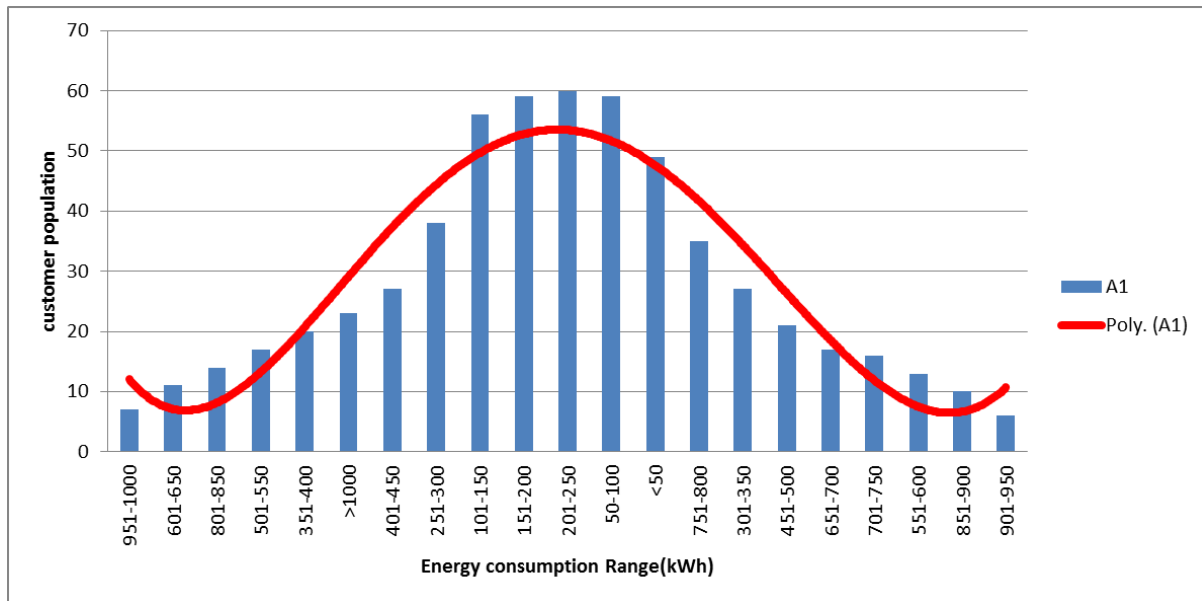


Figure 3: Distribution of A1 customer population with Energy Consumption Ranges

The modal range in the above distribution is the range 201-250. A further analysis shows that 58.8% of the population consume less than 250 units while 45.6% consume less than 200 units. The implication is that a cap of 250 will put 58.8% of unmetered customers in this class at the risk of paying more than their actual consumption. If we adopt 200 units, only 45.6% of unmetered customers in this class are at the risk of over billing. Hence to further reduce the error level, 100 units is adopted as the cap for this class.

Impact of Capping A1 at 100 kWh/month

The MYTO 2.1(amended) Order put the population of A1 customer at 17,254 with an annual consumption of 290748616.6kWh.

Based on the current metering gap analysis submitted by the DISCOs, 53.66% of their registered customers are unmetered. Hence population of unmetered A1 customer = 53.66% of 17,254 = 9258

The order also puts expected industry revenue from A1 customers as N 5.532 Billion hence at the current metering level, the expected revenue from unmetered customers (53.66% of 5.532 Billion) =N 2.968 Billion .

If all the unmetered A1 customers are billed at the capped amount, the industry revenue from the unmetered A1 customers will be population of unmetered A1 customer x average energy charge based on the A1 cap x 12. i.e $9258 \times 2212.3 \times 12 = 0.246$ Billion

Industry revenue impact of capping A1 is N 2.968 Billion – N 0.246 Billion =N 2.723 Billion

Over all industry Impact

Total industry impact= $3.769+4.004+2.723 =N10.496$ Billion. This is the shortfall the industry stand to suffer due to the cap if the metering level remains the same. This is the financial incentive for the DISCOs to accelerate their meter rollout. Based on the current industry-wide metering gap, a total 4,462,262 meters are required to fill the metering gap for the three categories of customers. Hence the opportunity cost of each meter is N 10.496 Billion/4,462,262 which amount to N2,352.20 per meter. Using an average meter life span of 10 years, the opportunity cost of not installing a meter is $N2352.20 \times 10 = N23,522$ which is very close to the actual cost of installing a meter.

The Commission is cognizance of the possibility that one possible consequence of capping will be that the DISCOs may illegally slam every unmetered customer with the maximum consumption allowed which may lead to the completely removal of R1 customer class or the overbilling the very low consumers in A1, C1 and R2 consumer classes.

Such customers who believe their actual consumption is much lower than the capped amount should avail themselves the opportunity to be metered within forty-five days through the CAPMI scheme and once such customers pay for meter under CAPMI they must be metered within the forty-five days period or the DISCO will be in violation of the

Commission's CAPMI regulation and the Commission may then impose appropriate regulatory sanctions until functional meter is installed.

It is expected that the DISCOs will hasten to meter those customers consuming above the new Cap threshold to reduce their revenue loss. As they progressively reduce the number of unmetered customers in these group (customer consuming above the allowed estimation threshold) the Commission will tighten the cap again to create new metering priority frontiers for the DISCOs.

8. Order to Cap Estimation of Energy Consumption in NESI

The Nigerian Electricity Regulatory Commission in exercise of the powers conferred on it by section 96 of the EPSR Act 2005 and all other powers enabling it in that behalf, desiring to incentivize the DISCOs to fast-track the meter roll-out and protect vulnerable unmetered customers of R2, C1 and A1 class from outrageous and arbitrary estimated billing hereby approve the following caps for estimated energy billing for unmetered customers in all the distribution companies.

Caps on estimated energy consumption (kWh)

R2: 125 kWh/Month

C1: 125 kWh/Month

A1: 100 kWh/Month

Applying the extant tariff for these classes of customers as shown in table 2 below, the monthly cap for unmetered customers in monetary terms is as shown in table 3.

Table 2: Applicable Extant tariffs for R2, C1 and A1 customer classes

DISCO	Fixed Charge(N/month)			Energy Charge(N/kWh)		
	R2	C1	A1	R2*	C1	A1
Abuja	702	702	702	23.32	23.61	23.16
Benin	750	1000	1000	18.75	20.72	19.04
Eko	750	750	750	18.75	19.00	20.42
Enugu	650	650	650	20.89	23.02	25.81
Ibadan	625	500	500	18.00	19.06	20.69
Ikeja	750	750	750	14.96	19.9	18.84
Jos	775	775	1395	20.18	25.95	25.63
Kaduna	800	800	800	20.66	23.52	24.62
Kano	667	667	667	18.34	20.1	21.22
Port Harcourt	700	700	980	17.98	21.75	21.24
Yola	750	750	750	19.44	23.17	22.68

*values of R2 tariff used in this paper assume R2 tariff-freeze will be lifted before the effective date of this order

Table 3: Maximum Energy and monetary cap for unmetered R2, C1 and A1 customer classes

DISCO	Cap (kWh)/Month			Total Energy Charge(Naira/Month)			Total Energy charge + Fixed Charge (Naira/Month)		
	R2	C1	A1	R2**	C1	A1	R2	C1	A1
Abuja	125	125	100	2915.0	2951.3	2316.0	3617.0	3653.3	3018.0
Benin	125	125	100	2343.8	2590.0	1904.0	3093.8	3590.0	2904.0
Eko	125	125	100	2343.8	2375.0	2042.0	3093.8	3125.0	2792.0
Enugu	125	125	100	2611.3	2877.5	2581.0	3261.3	3527.5	3231.0
Ibadan	125	125	100	2250.0	2382.5	2069.0	2875.0	2882.5	2569.0
Ikeja	125	125	100	1870.0	2487.5	1884.0	2620.0	3237.5	2634.0
Jos	125	125	100	2522.5	3243.8	2563.0	3297.5	4018.8	3958.0
Kaduna	125	125	100	2582.5	2940.0	2462.0	3382.5	3740.0	3262.0
Kano	125	125	100	2292.5	2512.5	2122.0	2959.5	3179.5	2789.0
Port Harcourt	125	125	100	2247.5	2718.8	2124.0	2947.5	3418.8	3104.0
Yola	125	125	100	2430.0	2896.3	2268.0	3180.0	3646.3	3018.0

**values of R2 Energy Charge used in this paper assume R2 tariff-freeze will be lifted before the effective date of this order

9. Implementation

1. The order on capping will take effect on the day it was signed with 4 months moratorium from the date of signing the order.
2. It is expected that all those who have paid for CAPMI meters are fully serviced before the expiration of this moratorium of 4 months and failure to fulfill this obligation to customers will attract appropriate sanctions in line with Section 11 of the Commission's Enforcement Regulation.
3. All estimates being imposed by DISCOs within the moratorium period shall be strictly based on the Commission Billing Estimation Methodology. As soon as the capping regulation commences, the extant regulation on estimation methodology will be vacated and DISCOs are expected to meter all unmetered customers within the period of two (2) Years from the start date.
4. After the period of two years, four months from the start of these orders all exiting unmetered customers will not be billed. 'No meter no payment of bill'.
5. Thereafter all new customers must be metered at the point of connection. 'No meter no connection'