Zrosk Investment Management

Nigeria | Industry | Power Sector

Overview

Numerous obstacles confront both households and businesses in Nigeria within the power sector. Primarily, the nation grapples with an unreliable and inconsistent electricity supply despite having an installed capacity of around 17GW, utilization is under 50%. Before offering remedies to the state of things, it is imperative to gain a comprehensive understanding of the workings of electricity, the industry reforms, and the broader power infrastructure.

Power Generation

Power is very essential in many things we do. It can come in various forms and can be generated through various means as well. It is simply the rate of flow of electrical energy and is a function of current (I) and voltage (V). How power is generated always follows the first law of thermodynamics, which simply states that energy is neither created nor destroyed, rather is just converted from one source to another. For instance, the power generated by electric batteries is simply a conversion from chemical to electrical and the power from hydro plant is simply the conversion from kinetic to mechanical to electrical energy.

Power is of two types; **direct current** (DC) and **alternating current** (AC) power, with the main difference being that the DC power travels on a straight line at the same frequency, while the AC alternates like a wave as it travels. The electronics at home are always designed to use DC power and power stored in batteries is also in this form. However, when you want to deal with supplying power to a large group and to transmit it to a very long distance, the AC becomes the best option. The reason for this is the difficulty associated with generating and transmitting DC at a high voltage and also the difficulty of handling DC in a transformer. It is quite cheaper to generate and transmit AC power over a longer distance.

In Nigeria, AC power is usually generated at a voltage of **10-16 kilovolts** (kV), using various generating techniques. After generation, in order to transmit the power over a longer distance with minimal loss, the voltage needs to be higher, hence, it is stepped up to **330kV** by a step-up transformer. The higher the voltage, the lower the current, and the lower the heat losses. The Transmission Company having received the 330kV steps the voltage down to **132kV** for further transmission to distribution/injection stations since the distance is now closer. The distribution companies further step it down to **33kV** and **11kV** for distribution to industrial and household areas respectively. Because the 11kV line cannot be routed directly into homes, a distribution transformer is needed to step down the 11kV to **0.415kV** (415 volts). The 0.415kV line is 3-phased and just one of the lines plus a neutral is **0.220kV**, which is needed for residential uses. This means the light that goes into sockets at home is averagely 0.220kV (220 volts).

The different voltages at the different stages are mainly to optimize the system and minimize losses. As a rule of thumb, the higher the amount you want to transmit, the higher the voltage you should adopt. The reason is that heat loss is directly proportional to the square of the current. So, to minimize heat losses, the priority is to maximize voltage as much as possible.

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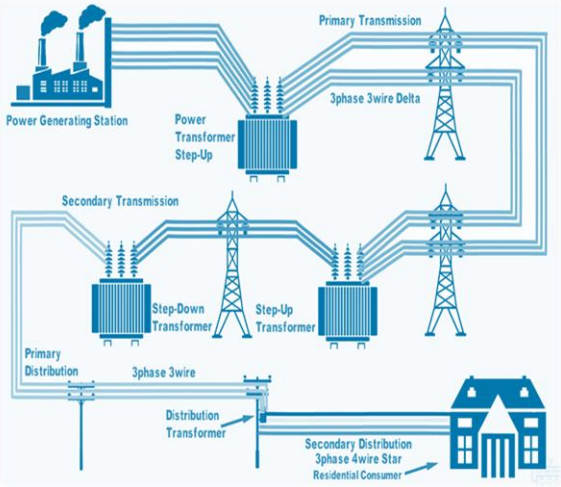
Power Generation, Transmission and Distribution Process



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Evolution of the Nigeria Power Sector

Power generation in Nigeria began in Lagos in 1886 with the use of generators to provide 60kW of electricity. In 1923, tin miners installed a 2 MW plant on the Kwali River, then 6 years later, the Nigerian Electricity Supply Company, a private firm, was established near Jos to manage a hydroelectric plant at Kura to power the mining industry. Between 1886 and 1945, series of private enterprises were established to serve industrials and, the colonial government also created an electricity department within the Public Works Department, to install generating sets across cities to serve government reservation areas and commercial centres.

By 1951, in a bid to integrate the electricity industry, the Electricity Corporation of Nigeria (ECN) was established to generate and supply electricity in Nigeria, managing 46MW at the time. Between 1952 and 1960, the firm established coal-powered turbines at Oji and Ijora, Lagos, and by 1965 it had completed a 132 kV transmission line linking Lagos to Ibadan, Oshogbo, Benin, and Ughelli. In 1962, a statutory organization, the Niger Dams Authority (NDA), was formed to build and maintain dams along River Niger and Kaduna River. The two organizations, the ECN and NDA, were merged in 1972 to form the then National Electric Power Authority (NEPA). NEPA was a public monopoly and was solely responsible for power generation, transmission, and distribution until 2005 when its name was changed to the Power Holding Company of Nigeria (PHCN). By 2000, installed capacity in the country had grown to 5,906MW.

In 2005, the Electric Power Sector Reform Act (EPSRA) was formed, and it made provision for the unbundling of the PHCN into 18 successor companies: 6 generation companies (GenCos), a transmission company- the Transmission Company of Nigeria (TCN) and 11 distribution companies (DisCos) (**Figure 1)**. The total installed capacities of the GenCos at the time was 6,656MW but with an average available capacity of 3,736MW. This means that only c.56% of installed capacity is being utilized. In 2005, the federal government also conceived the National Integrated Power Projects (NIPPs) where 10 power stations were to be funded and managed by the Niger Delta Power Holding Company (NDPHC).

In 2010, the Nigerian Bulk Electricity Trading Plc (NBET) was established as a credible off-taker of electric power from generation companies. The NBET was typically responsible for paying for the electricity supplied by the GenCos. By November 2013, the privatization process of all GenCos was completed, PHCN ceased to exist, and the Nigerian Electricity Regulatory Commission (NERC) was formed in its stead. The total installed capacity of the plants by 2014 had increased to 8,876MW but with an available capacity of only 3,795MW (only a 1.6% increase in available capacity from 2005, but utilization rate essentially dropped from c.56% to 42%).

As for the 18 successor companies, while the GenCos were solely privatized, the government retained sole control in the TCN and 40% control in the DisCos. Considering the market gap and need for power, we have seen lots of private participation in the power sector from 2005 till date, as we currently have 27 generation companies as of Q4'2023.

Deregulation

In a bid to further decentralise the industry, a new Electricity Act was signed into law in February 2023. The law allows for states to make regulations on electricity matters (generation, transmission and distribution) within their state borders. It also conferred exclusive powers on states with respect to mini-grids licensing supporting renewable energy sources.

This allows state-licensed private investors to support state-focused electricity markets. As of January 2023, 7 states (including Lagos, Osun, Enugu, Akwa Ibom, Rivers, Delta and Kogi) had commenced the implementations of a state electricity Act.

However, there are some issues with the Act with regards to the feasibility of economically weaker states owning their own power system and grid. There is also the risk of overlap in licensing and the non-explicit definition of mini-grids.

Figure 1: PHCN Unbundling

Successor GenCos	Transmission	Successor DisCos
Kainji/Jebba	Transmission	Abuja
Shiroro	Company of	Benin
Egbin	Nigeria (TCN)	Eko
Sapele		Enugu
Delta		Ibadan
Afam IV-V		Ikeja
		Jos
		Kaduna
		Kano
		Port Harcourt
		Yola

Value Chain

The Nigerian power sector value chain is segmented by power generation source, transmission, and distribution. In addition to these segments, there are key power industry players that are incredibly influential. These key players are the Nigerian Bulk Electricity Trader (NBET), System Operator (SO), and the Nigeria Electricity Regulatory Commission (NERC).

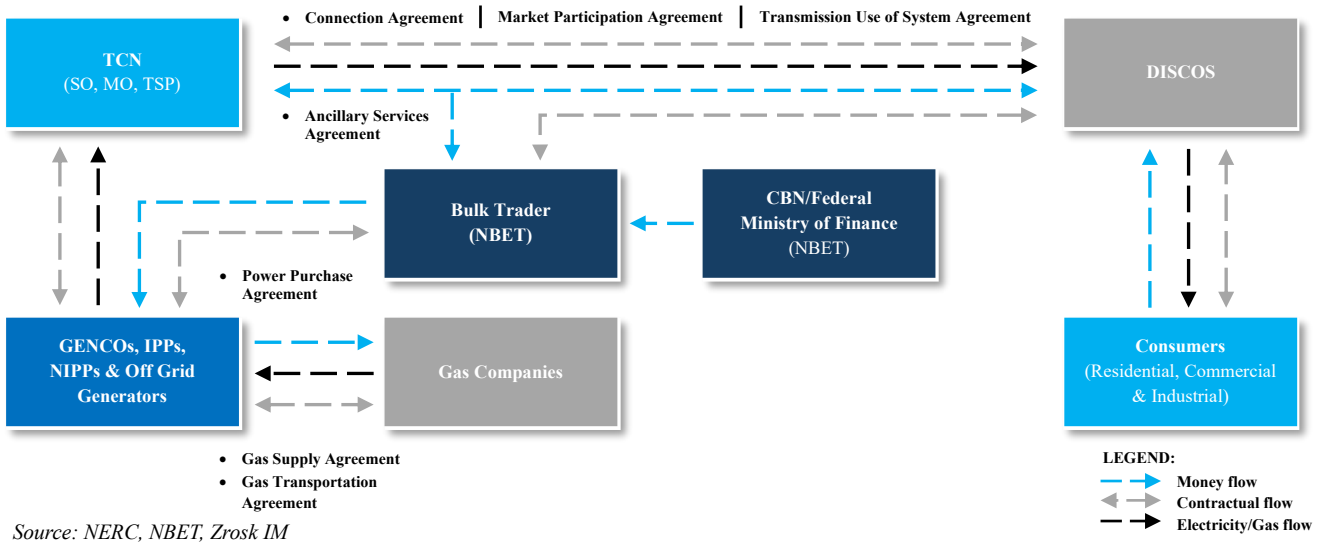
Typically, the way the power sector **works** as earlier established is, electricity is first generated by power generation companies (GenCos), who utilize a source of energy (gas, water, or steam) to do so. The electricity generated is thereafter routed to the Transmission Company of Nigeria (TCN)'s national grid, which then transmits this electricity to its sub-stations and then to distribution companies. The final step is for the distribution companies (DisCos) after getting allocations from the TCN to distribute electricity to the end users, which are households and businesses**.**

It is important to note that electricity flows through these 3 stages **simultaneously** as Alternative Current (AC) power cannot be stored. This process is specifically for the on-grid sector, as we also have off-grid captive power generation, embedded generation and mini-grid developments who do not rely on the national grid.

Having understood how electricity flows from the GenCos to TCN and DisCos, it is important to note that money flows in the opposite direction. The end users pay DisCos for electricity consumed, and they in turn pay the TCN and the GenCos. However, due to concerns like low electricity tariffs, revenue collection issues and electricity theft, NBET was birthed to address interim cash flow concerns. NBET collects revenue from DisCos and pay GenCos for electricity supplied, while DisCos pay TCN the transmission and service charges. **(Figure 2)**.

While NBET helps balance cash flow, System Operators (SO) helps balance electricity flow, which is typically ancillary services. These services are crucial to ensuring that the power being generated matches the power that is being consumed. Essentially, SO is responsible for maintaining system stability, and ensuring fair access to the grid for all market participants. Nigeria Electricity Regulatory Commission (NERC) on the other hand is the sole regulatory body responsible for managing the sector. From setting tariffs to providing licenses, NERC is the single most important organization in the electricity sector.

Figure 2: Value Chain – Electricity Trading and Payment Structure in NESI



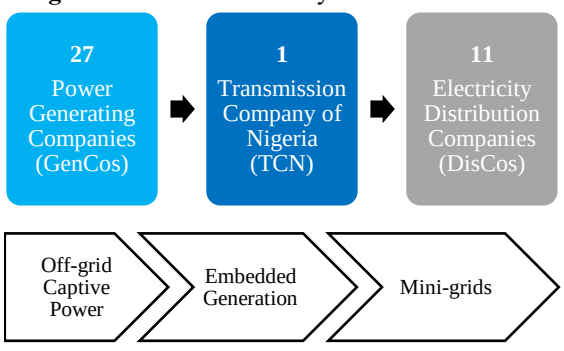
Source: NERC, NBET, Zrosk IM

The next section will expatiate on the various segments of the sector, as well as electricity pricing and bottlenecks.

Segments

In Nigeria, there are three key players in the power sector. They include the 27 power generating companies (GenCos), the 11 electricity distribution companies (DisCos), and the Transmission Company of Nigeria (TCN). We also have other players like the off-grid captive power generation, embedded generation, and mini-grid developments **(Figure 3).**

Figure 3: Power Sector Players



Source: NERC, Zrosk IM

Captive power plant is an electricity generation facility used and managed by an industrial or commercial energy user for their own energy consumption, with installed capacity exceeding 1MW.

The Embedded power generation is the generation of electricity that is connected directly to and evacuated through a distribution network either of a successor DisCo or an Independent Electricity Distribution Network (IEDN) operator.

While a mini-grid is a set of small-scale electricity generators interconnected to a distribution network that supplies electricity to a small, localized group of customers, with installed capacity of 0-1mw.

Generation

According to NERC, Nigeria has 27 Grid connected electricity generating plants with an installed capacity of 12,672MW as of Q4'23. Of the 27 power plants, there are nineteen (19) gas, four (4) hydro, two (2) steam, and two (2) gas/steam-powered plants. This means the power stations that make use of thermal energy (gas and steam) represent 78% of total number of grid-connected plants, and c.85% in terms of installed capacity – 10,702MW **(Figure 4).** However, by generation, thermal contributed 75% of total generation for 2023 – 27,591GWh (**Figure 5).**

In terms of the on-grid licences, Successor GenCos accounts for 52.4% (6,639MW), National Integrated Power Projects (NIPPs) accounts for 25% (3,173MW) and Independent Power Projects (IPPs) accounts for the remaining 22.6% (2,860MW) of the total capacity **(Figure 6)**.

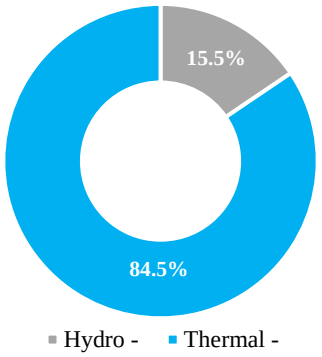
The Successor GenCos are privatized power plants previously owned by the Federal government, while those owned by state governments and private organizations are referred to as Independent Power Projects (IPPs). The National Integrated Power Projects (NIPPs) were conceived by the federal government in 2005 to aid the electricity industry by funding gas projects and are managed by the Niger Delta Power Holding Company (NDPHC).

As revealed in 2022 by the then Federal Minister of Power, Nigeria has "266 captive generation power plants with installed capacities of 4,000MW and daily operational capacities of around 2,500MW. Nigeria also had sixteen (16) embedded power plants with 549MW of installed capacities and about 190MW of daily operational capacity". This takes the total installed capacity in the country to around 17GW.

While on-grid installed capacity is 12,672MW, available capacity as of Q4'23 was only 4,922MW, c.39% of installed capacity. Of the available capacity, actual generation was 90% of available (4,433MW), indicating that c.10% of available energy was not dispatched in the quarter. A 90% utilization rate is quite fair, however the gap between installed and available capacity is very alarming.

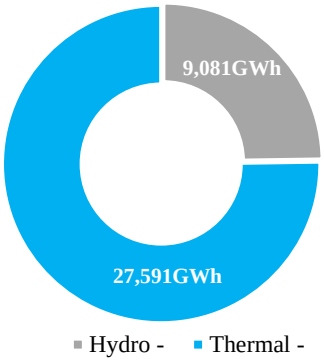
Available capacity has been on the dwindle over the years since 2019 (**Figure 7**). These can be attributed to a couple of factors like, depreciation of aged plant equipment, insufficient gas supply to fully power the plants or inadequate water to power the plants and many other reasons. Considering the capital-intensive nature of the sector, in order

Figure 4: Installed Capacity (Q4'23)



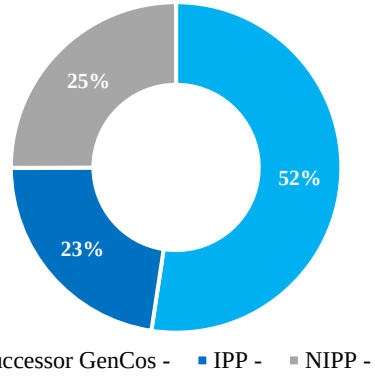
Source: NERC, Zrosk IM

Figure 5: Generation by source (2023)



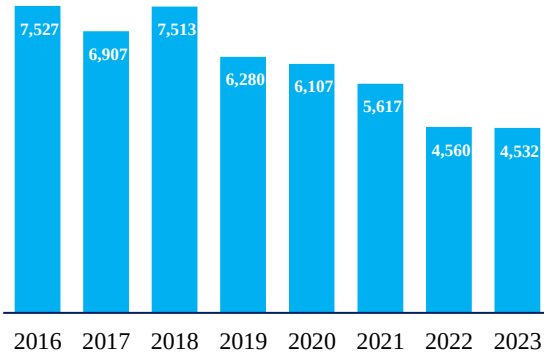
Source: NERC, Zrosk IM

Figure 6: On-grid Licenses



Source: NERC, Zrosk IM

Figure 7: Available Capacity (MW)



Source: NERC, World Bank Indicators, Zrosk IM

to maximize capacity, investments need to be made. GenCos have not bothered much to improve capacity, which is largely driven by liquidity issues and lack of incentives to attract new investments.

Over the years, electricity generation has grown from 14,507GWh in 2000 to 36,672GWh in 2023. While this represents a significant increase of 153%, the growth has not been as rapid since 2015 when generation was 31,593GWh **(Figure 8)**. The reason for this is the decelerating growth in investment in the sector. Private investments in the sector grew from $295m in 2001 to $828m in 2005 and $880m in 2015, with series of years of no investment **(Figure 9)**. To improve the low value derived from the installed capacity, the government has been making efforts to decentralise the Nigerian Electricity Supply Industry (NESI) and bring in private players who have capital to get more involved.

Generation is also hindered by the gas supply chain as most of the power plants in Nigeria (c.80%) make use of gas-fired turbines to generate electricity. To address gas supply issues, the government has been providing incentives for gas production, including setting a domestic price ceiling for marketable gas. Recently, gas price for GenCos was pegged at $2.42/mmbtu from $2.18/mmbtu, which is still way cheaper than gas prices in other African countries averaging c.$4.66/mmbtu **(Figure 10)**. However, the gas payables still owed to suppliers due to NBET owing GenCos is still a concern.

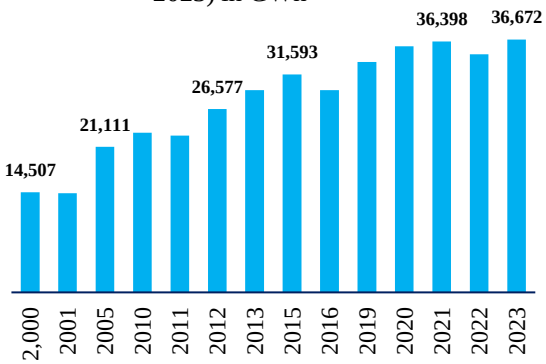
Typically, GenCos make money from two sources; **capacity charge** and **electricity supplied tariffs**. According to the Nigerian Electricity Supply Industry (NESI), GenCos enter into contracts to have a particular capacity to supply the DisCos and get paid monthly for having that capacity available. If they do not have the agreed upon capacity monthly, they are expected to pay obligations for that. They also get paid for the electricity they supply the TCN, charged based on kWh/h.

Electricity is like any other manufactured product and its major costs are cost of inputs, such as fuel (e.g. natural gas), and capital items, such as turbines, cables, switchyards, etc. The industry is highly capital intensive and as earlier established, electricity cannot yet be economically stored as it is produced. The implication of instantaneous supply and consumption is that price must be sufficient to cover the cost of production, otherwise supply will be jeopardised. If electricity is under-priced, then supply will not meet demand.

Currently, in Nigeria there is a significant portion of the population who do not have access to electricity. The percentage of Nigerians that have access to electricity is just around 60% as of 2022, leaving 40% of the inhabitants in the dark **(Figure 11)**. Tackling those power grid issues while the population grows rapidly remains one of the challenges the Nigerian government faces to ensure economic development.

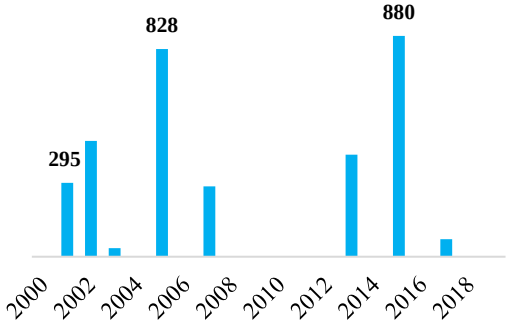
The amended Electricity Act, signed into law in February 2023, provided a brightened outlook for the sector. Summarily, the provisions now allow states to generate, transmit, and distribute electricity within their respective domains. There is also leeway for state-licensed private sector investors (companies and individuals) to support state-focused electricity markets by engendering greater competition, efficiency, and transparency. That said, states are required to first enact their electricity

Figure 8: Electricity Generation (2000 - 2023) in GWh



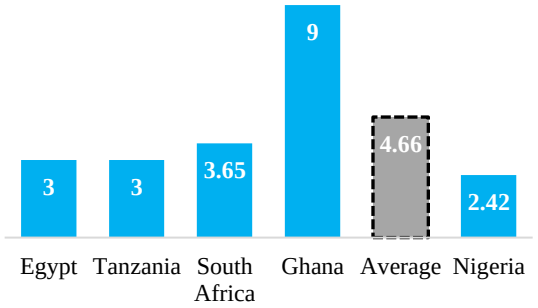
Source: NERC, World Bank Indicators, Zrosk IM

Figure 9: Private energy investments



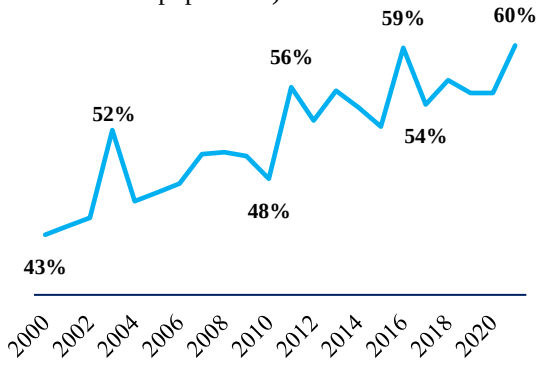
Source: World Bank Indicators, Zrosk IM

Figure 10: Gas Prices ($/mmbtu)



Source: Africa Oil and Gas, Zrosk IM

Figure 11: Access to Electricity (% of population)



Source: World Bank Indicators, Zrosk IM

market laws before they or private sector investors can participate in the generation, transmission, and distribution of electricity.

While there are some areas of the Act which are unclear and risks of overlap exist, like the definition of mini-grids and the operation coverage of new plants not being in areas already served by the national grid, this is a step in the right direction, with a need for a review of the Act to ensure more clarity and effectiveness of the law.

Transmission

The second segment of the sector is the transmission of the power generated. Power connected to the national grid is usually generated at 10-16 kilovolts (kV) which is then stepped up to 330kv for transmission to various substations. It is further stepped down at these substations to 132kv before being distributed. Power transmission in Nigeria is handled by the Transmission Company of Nigeria (TCN), one of the products of the unbundling of PHCN.

TCN is the sole electricity transmission company in Nigeria, and it is 100% government owned. There are 27 power plants connected to the national grid, meanwhile, it only has the capacity to wheel **8,100MW** bulk electricity from these plants to distribution load centres nationwide. This represents a market gap of 36% of the installed capacity of 12,672MW (**Figure 12**). This reduces incentives for GenCos to increase available capacity and generation.

Currently, TCN is made up of three arms, which are the;

Transmission Service Provider (TSP) – in charge of the maintenance of the transmission infrastructure and administering transmission tariff;

Independent System Operator (ISO) – which oversees the flow of electricity from the point of generation to the DisCos and

Market Operator (MO) – in charge of administering the market rules of the electricity supply industry, invoicing of electrons transmitted to the distribution companies and ensuring corresponding payment as agreed.

Typically, there are 3 main charges the TCN receives which are the;

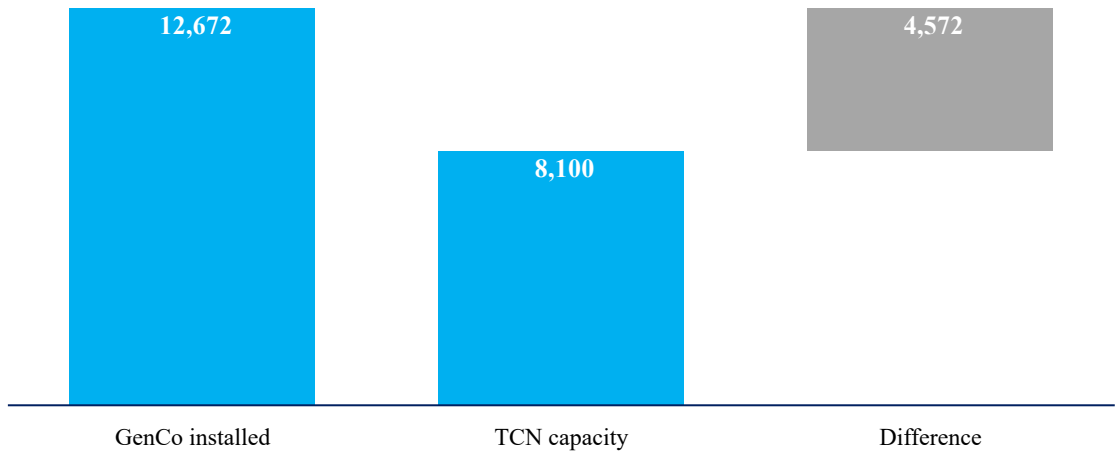
Connection charge - charged against new GenCos and covers the cost of connecting new generators to the grid;

Transmission Use of Service (TUOS) charge - which essentially stands as the transmission tariff, applied to each unit of energy delivered to DisCos as determined by NERC and is billed monthly, and

Transmission losses charge - to tackle the transmission loss factor, GenCos are required to make an allowance for a marginal loss, by providing extra units of electricity.

Although power transmission is solely government-run, there are provisions for private sector investments The incessant losses in the transmission network, cost of transmission and difficulties in expanding the transmission network are the major reasons for the call for off-grid power generation.

Figure 12: Generation - Transmission Market Gap (MW)



Source: NERC, Zrosk IM

Distribution

The third segment of the sector is the distribution of the power transmitted to the end users. Electricity can be generated and distributed from the generation point. It can equally be transmitted to far distances before being distributed. In the case of Nigeria, the power plants connected to the national grid supply electricity to the grid for transmission to various parts of the transmission network for distribution.

There are two categories of electricity distributors in Nigeria. The first is the **Successor Distribution Licensees** (Successor DisCos), which was formed when PHCN was unbundled, with the government retaining 40% of the shares in each DisCo whilst the remaining 60% of shares are held by private investors. The unbundling of PHCN created eleven (11) power distribution companies which still exist to date (**Figure 13**).

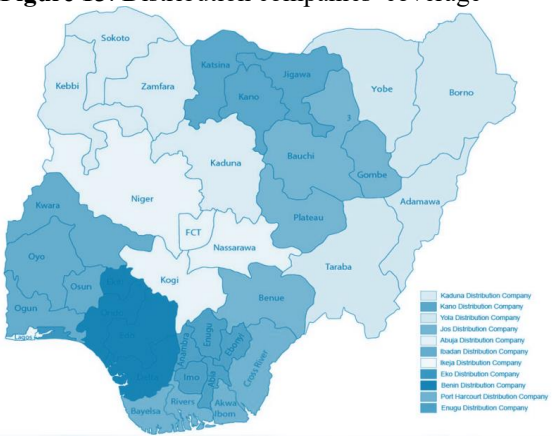
Energy distributed last year through these DisCos averaged 3,422MWh/h per quarter, which represents c.83% of the average generation of 4,152MWh/h across the quarters (**Figure 14, 15**). This differential is majorly from transmission losses, international/bilateral offtakes and DisCos not taking their full Partially Contracted Capacity (PCC) due to a combination of technical limitations as well as load rejection largely due to commercial reasons.

Since July 2022 when the NESI transitioned to the Partial Activation of Contract (PAC) regime, the target volume of energy to be off-taken by DisCos at any time was defined as their Partially Contracted Capacity (PCC). Under the PAC regime, DisCos have take-or-pay obligations on their PCC which means that they must pay for available capacity irrespective of their offtake. This structure is consistent with international best practices for long-term contract-based power procurement and ensures that GenCos earn capacity payments to compensate them for availability. The PAC also mandates GenCos or TCN to compensate DisCos through Liquidated Damages (LD) in the event of capacity shortfalls.

Another thing to look at on the part of the DisCos is the billing efficiency, which measures the proportion of energy billed to customers (including metered and unmetered customers) relative to the total energy supplied to a given area over a period. The total energy offtake by all DisCos in 2023/Q4 was 8,198.65GWh and the total energy billed was 6,432.22GWh, which translates to a billing efficiency of 78.45% **(Figure 16)**. The key drivers of billing losses are **technical** - energy loss in distribution lines; and **commercial** - DisCo's inability to account for 100% of the energy supplied.

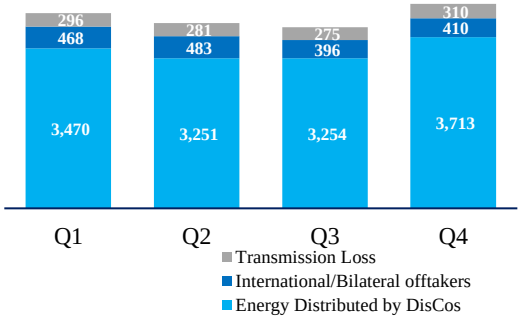
There is also collection efficiency which is the ratio of the amount that has been collected from customers relative to the amount billed to them. In 2023/Q4, of the 78.45% billed, only 73.79% of that amount was realized **(Figure 17)**. The significant under-recovery of the invoices issued to customers by DisCos is driven by a lack of willingness of customers to pay bills when due, unsatisfactory DisCos' services and inadequate customer metering among other challenges.

Figure 13: Distribution companies' coverage



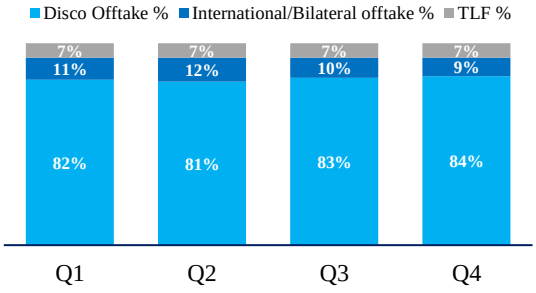
Source: NERC, Detailsolicitors, Zrosk IM

Figure 14: Breakdown of Generation - Distribution (Q1-Q4'2023)



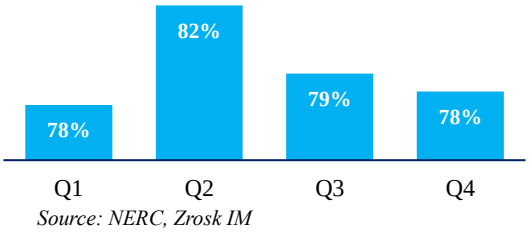
Source: NERC, Zrosk IM

Figure 15: % of Energy offtake



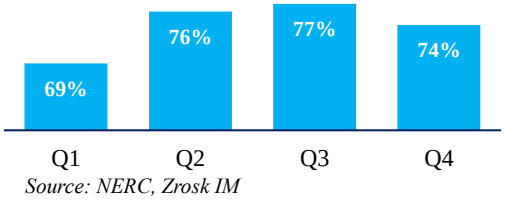
Source: NERC, Zrosk IM

Figure 16: Billing efficiency (2023)



Source: NERC, Zrosk IM

Figure 17: Collection efficiency (2023)



Source: NERC, Zrosk IM

The second category of electricity distributors in Nigeria is the **Independent Electricity Distribution Networks** (IEDNs) operators. They are distribution companies that are licensed to distribute power either where there is no existing DisCo's network within the area or where the network of the existing DisCo is unable to satisfy the demand of customers in that area. More specifically, an IEDN can be licensed as; **Embedded IEDN** – This is an IEDN connected to a distribution network that is connected to the TCN network; **Isolated Off-Grid Rural IEDN** – This is an IEDN in a rural area which is not connected to a DisCo's network that is connected to the TCN network; or **Isolated Off-Grid Urban IEDN** – This is an IEDN in an urban area which is not connected to a DisCo's network that is connected to the TCN network.

As of December 2022, NERC had issued seventeen (17) IEDN licenses of which 10 are operational. The number of IEDN licensees can be expected to increase significantly because the Electricity Act 2023 now enables State Houses of Assembly to legislate for the issuance of IEDN licenses provided the licensee does not engage in inter-state or transnational distribution of electricity under the license. Also, the State Electricity Boards or other relevant authority within each State are also empowered to grant IEDN licenses, provide the framework for operation of IEDN licensees and investment in electricity utilities within the State.

Having walked through the various segments of the power sector value chain, would be great to understand more about the Nigerian Bulk Electricity Trading (NBET), electricity pricing, challenges and bottlenecks.

Nigerian Bulk Electricity Trading (NBET)

The Nigerian Bulk Electricity Trading (NBET) Plc. (NBET) is the manager and administrator of the electricity pool ('The Pool') in the Nigerian electricity supply industry (NESI) and is 100% owned by the government. It was incorporated on July 29, 2010, in line with the "Roadmap to Power Sector Reform" and, in fulfillment of the requirements of the Electric Power Sector Reform Act (EPSRA) of 2005. NBET's mandate is to engage in the purchase of electrical power and ancillary services from GenCos under long-term power purchase agreements (PPA), and the resale of electric power to DisCos and eligible customers under vesting contracts. Typically, NBET is the company that buys power from GenCos and sells to DisCos and then settles the invoices.

Electricity pricing

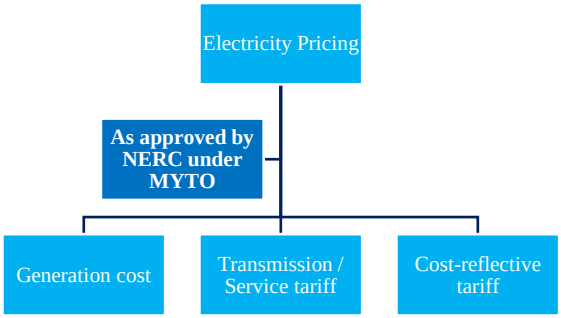
Electricity pricing in Nigeria is divided into three. One, for generation, transmission and the other for distribution, which is regulated by the Nigerian Electricity Regulatory Commission (NERC) under the principle called Multi-Year-Tariff-Order (MYTO). **Figure 18**

According to NERC, the principles and assumptions on which electricity pricing is based include cost recovery, attraction for investment, security, certainty, return on investment and the efficient use of the network. The cost recovery is aimed at a reasonable return on capital, while the investment principle is designed to attract local and gobal investors.

The MYTO sets the appropriate tariff for generation and distribution by factoring in a couple of indices like, exchange rate, US and Nigeria inflation rate, available capacity, and gas prices, amongst others. The MYTO is usually reviewed annually with supplementary reviews during the year to factor in macroeconomic changes.

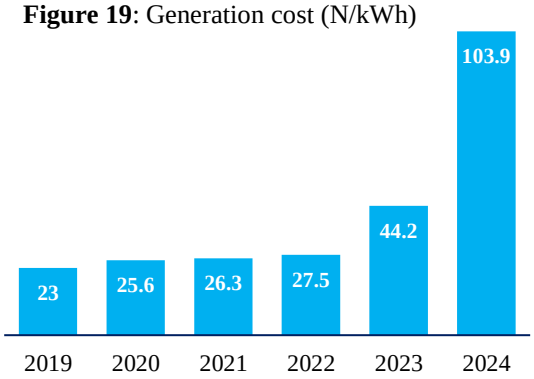
To arrive at the appropriate tariff paid to GenCos, the following things are considered; gas prices, plant maintenance cost, operating expenses, a margin percentage to be approved by NERC and depreciation charge. It is important to note that all of these are priced in dollars due to the nature of the costs. The rising exchange rate and gas prices has led to multiple repricing of generation cost as we saw generation cost move from N23/kWh in 2019 to N44.2/kWh in 2023 and now N103.9/kWh as of April 2024 **(Figure 19)**. This shows that the GenCos are able to pass on their costs, although it needs to be approved by NERC. While this is good for the GenCos, the fact that NBET owes a chunk of the amount

Figure 18: Electricity Pricing in Nigeria



Source: NERC, Zrosk IM

Figure 19: Generation cost (N/kWh)



Source: NERC, Zrosk IM

payable to the GenCos is concerning. According to the data gotten from NBET, it showed that through 2022, from the GenCo invoice NBET received, only an average of 60% was settled, leaving a whopping backlog of 40% of invoice plus accrued interest **(Figure 20).**

For the transmission tariff, as earlier established, it is comprised of the cost of servicing the transformer charged against the DisCos and billed per kWh energy delivered. The TCN have autonomy in deciding this considering the fact that it is a service and administration charge. Transmission tariff has been less volatile over the years compared to generation costs **(Figure 21)**.

The third electricity tariff is that applicable to distribution companies (DisCos). To arrive at the appropriate cost-relective tariff that DisCos charge customers, they factor in the generation costs, transmission charge, OPEX, metering cost and a margin to be approved by NERC. It is important to note that distribution tariff varies across DisCos and also by the type of service bands.

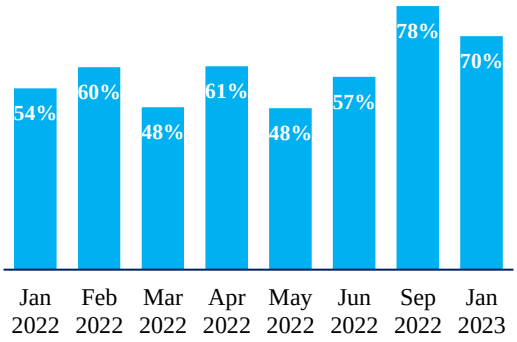
The service bands are basically Band A – E. Band A customers are being supplied power a minimum of 20hrs/day. Band B are supplied power for a minimum of 16hrs/day. Band C are supplied power for a minimum of 12hrs/day. Band D are supplied power for a minimum of 8hrs/day. Band E are supplied power for a minimum of 4hrs/day. Typically, the higher the minimum power supply, the higher the tariff to be paid by such customers.

Using Port Harcourt Electricity DisCo (PHED) as a case, we can clearly see that cost-reflective tariff has grown exponentially this year, from N69.85/kWh in 2019 to N186.6/kWh as of April 2024 **(Figure 22)**. This is majorly due to the rising generation costs and OPEX. However, while there is a cost-reflective tariff, it seems a little too high, hence, the Government, through the NBET, undertakes to cover the resultant gap (between the cost-reflective and allowed tariff) in the form of tariff subsidies **(Figure 23)**.

For ease of administration, the subsidy is only applied to the generation cost payable by DisCos to NBET, while the transmission and administrative service cost payable by DisCos to the Market Operators in TCN is recovered 100%. The share of the NBET invoice to be covered by DisCos is determined by the percentage of the generation cost they can recover from the allowed tariff and set out as their Minimum Remittance Obligation (MRO) in the periodic Tariff Orders issued by the Commission.

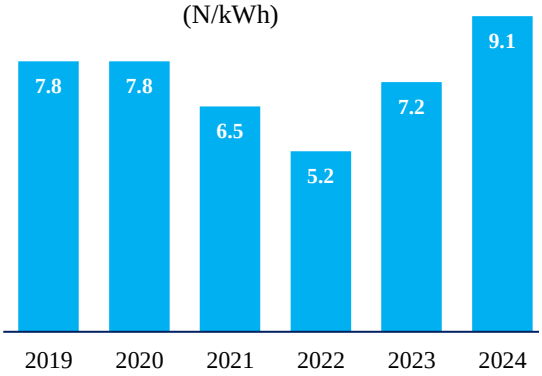
For GenCos to keep generating electricity (for gas-fired plants), they need to pay their gas suppliers. And to pay their gas suppliers as and when due, they need to get paid by NBET. Effectively, for NBET to pay GenCos for electricity supplied, they need to get remittance from the DisCos and supplement that with government subsidy. However, for DisCos to remit the invoiced amount, they need to have gotten payments from end users, which are often lagging. The interconnectedness of the space shows that our power problem is fundamental. The next segment would highlight some of the bottlenecks in the sector.

Figure 20: GenCos paid invoice %



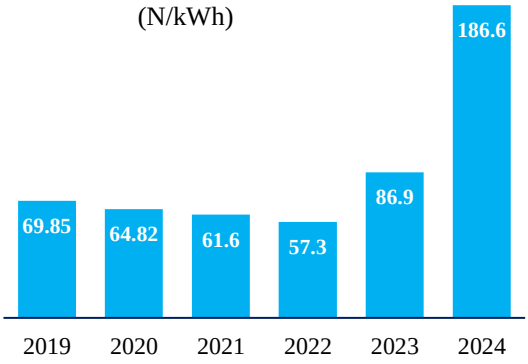
Source: NBET, Zrosk IM

Figure 21: Transmission/Service charge (N/kWh)



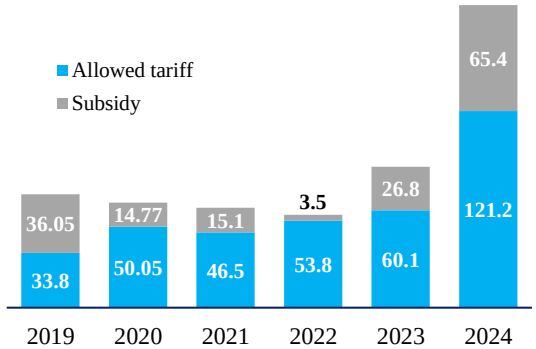
Source: NERC, Zrosk IM

Figure 22: Cost-reflective tariff (N/kWh)



Source: NERC, Zrosk IM

Figure 23: Breakdown of Cost-reflective tariff (N/kWh)



Source: NERC, Zrosk IM

Challenges and Bottlenecks

Gas Supply Disruptions: Nigeria's electricity generation mix consists of mostly gas combined cycle plants and gas open cycle plants. Therefore, the power sector is greatly affected by gas pipe vandalizations that occur in country as it forces the power generation plants to momentarily shut down for the issue to be resolved. Other issues around gas include a lack of development of more gas assets to supply power generators, and existing debts owed by the power sector to gas suppliers, which was recently reported at between $700 million to $1 billion dollars. This by implication means that this cycle of gas supply issues is expected to continue until these key issues are resolved.

Poor Transmission Network: The transmission network also operates with insufficient infrastructure to wheel electricity enough to meet the country's demand. Consequently, there are many incidences of grid failures. NERC reports that Nigeria's transmission network system had 4 total collapses and 2 partial collapses in 2022, with Five grid collapses in 2023. Data from TCN indicated that from November 2013 to December 2020, the number of recorded total grid failures was 84, while the grid partially collapsed 43 times. Investment in the system is therefore necessary to improve existing infrastructure and avoid system interruptions and associated load and revenue losses.

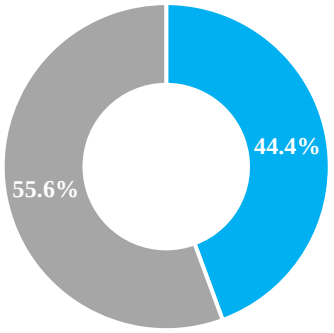
DisCos' Inability to improve on Distribution Infrastructures: The DisCos' failure to maintain and improve their network infrastructure causes load rejection and reduces the amount of electricity supplied to consumers. Also, as DisCos are encumbered by huge debts to banks amounting to N823.28 billion, debt servicing has taken priority on the DisCos' expenditure. This leaves little to no funds available for the DisCos to spend on infrastructure maintenance and upgrade.

The devaluation of the Naira has also increased operational costs to the DisCos and made it harder for them to meet their contractual obligations, especially as the current MYTO 2022 tariff is reflective of a Naira/USD exchange rate at N415.8 which is not reflective of current realities. Although the latest reviewed MYTO 2024 dated 6th May 2024 reflects a Naira/USD exchange rate at N1,227.78, the tariffs are frozen for all customers at the rates payable since December 2022 therefore the implementation of MYTO 2024 tariff is subject to further policy direction of the FGN.

Also, we note that DisCos are exploring innovative ways of overcoming this constraint, such as, by partnering with companies in the private sector to perform these maintenance and network enhancement functions, through embedded generation projects, embedded IEDN projects, or interconnected mini-grid projects.

Huge and Growing Metering Gap: The metering gap between metered customers of the 11 DisCos and their total registered electricity customers remains wide. According to NERC, as of 31st December 2023, only 5,842,726 (44.4%) out of the 13,162,572 registered electricity customers across the 11 DisCos were metered **(Figure 24)**. This leaves 55.6% of end-use customers still on estimated billing for lack of meters, a gap which NERC as of its assessment in July 2023, estimated will cost approximately N898.48 billion to close. The dire state of the metering system in Nigeria which has dampened collection efficiency, has made the entire system struggle with efficiency.

Figure 24: Metering gap (2023)



Source: NERC, Zrosk IM

Recommendations

Having understood the power sector in Nigeria, here is our view on things to focus on to improve the state of things.

While improving installed and available capacity is paramount, payment and transmission structures should first be revamped for that to be effective. For a start, focus should be on DisCos improving their distribution infrastructure and metering system. If this is achieved, it would be easier to bill and collect revenue from end users, which would then translate to swift and higher remittance to the GenCos. Secondly, the TCN should double down on increasing its wheeling capacity to at least, a level that can accommodate total current installed capacity. This would provide confidence on the part of the GenCos to improve available capacity and ultimately, generation. Thirdly, the government should provide incentives for private owners of capital to come into the sector, like sorting out liquidity concerns, allowing for more gas production and or providing tax rebates. We believe this will provide some sort of confidence and encourage investments and ultimately, improve generation.

Although the Electricity Act 2023 is a step in the right direction in terms of allowing private players, it lacks clarity on coverage as overlapping risks exists. Wholistically, effective reforms and capital is highly needed to boost the sector's performance.