PROSPECTS FOR UNIVERSAL ELECTRICITY ACCESS IN NIGERIA

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Table of Contents

Executive Summary ................................................................. 3
  Brief overview of Nigeria’s key indicators ......................................... 3

Political environment, institutions and governance of the energy sector ................................................................. 4
  Political environment ............................................................................. 4
  Institutions and governance of the post-privatization power sector ......................................................... 4
  Governance of rural electrification & prioritization of energy access in the political agenda ................................................. 4

Demand analysis and consumer characterization ........................................ 5
  Current status of the power demand .......................................................... 5
  Current Status of Energy Access ............................................................ 6

Electricity supply in the power sector ......................................................... 7
  Generation ......................................................................................... 7
    Grid-connected electricity generation ......................................................... 8
    Captive generation ............................................................................. 10
  Transmission ...................................................................................... 10
  Distribution ....................................................................................... 11
  Tariff Remuneration in the Electricity Sector ........................................... 13
    MYTO Tariff Methodology ................................................................. 13

Decentralized and off-grid electrification initiatives .................................... 14
  Analysis of the mini-grid sector ............................................................. 14
  Prospects for solar off-grid electrification ............................................... 15
    State of the PAYG solar sector ............................................................ 15

Business opportunities for integrated distribution companies in Nigeria ......................................................... 17
  Viability of integrated distribution business models: constrains and limiting factor .......................................................... 17
  Overall involvement scheme ................................................................. 17

Annex ............................................................................................... 19
  Annex 1 – Nigeria Power Sector Energy Flow ........................................ 19
  Annex 2 – Structure of the Post-privatization power sector ................................................................. 19

Bibliography ....................................................................................... 20
Executive Summary

Nigeria’s electricity supply remains sporadic and unstable, constituting a major bottleneck for the country’s economic growth. While around 80 million people of the country’s population remain deprived from any source of electricity, the privatization process has not led to significant results yet as the whole value chain remains largely constrained by inadequate gas supply and electricity pricing. However, an unparalleled market size and the momentum initiated by the privatization process have paved the way for significant business opportunities in the power sector. There are a number of opportunities for companies to bring their global skills and expertise to the financing and development of semi-integrated power projects, consisting in reinforcing generation capabilities and/or developing innovative on- and off-grid distribution business models.

Current regulatory frameworks do not allow for the development of financially sustainable integrated electrification approaches. However, structural reforms in electricity tariffs may soon pave the way for unprecedented business opportunities in both generation and distribution. From a governance standpoint, the flexibility of current regulations already allows DISCOs, mini-grid developers and PAYG solar companies to operate within the same area and coordinate grid management and extension activities with the deployment of mini-grids – by the DISCO or an external partner - and the diffusion of PAYG SHS – by an external partner only.

In conclusion, the adoption of transparent and long awaited cost-reflective electricity tariffs appears as the most critical condition for any private actor to engage into financially sustainable integrated distribution business models and invest in supporting generation assets.

Brief overview of Nigeria’s key indicators

<table>
<thead>
<tr>
<th>Macroeconomic indicators</th>
<th>Energy sector indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Population - 2016</strong></td>
<td><strong>Average consumption - 2015</strong> 155 kWh/y</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
</tr>
<tr>
<td>- Urban</td>
<td></td>
</tr>
<tr>
<td>- Rural</td>
<td></td>
</tr>
<tr>
<td><strong>Generation Capacity - 2016</strong></td>
<td></td>
</tr>
<tr>
<td>Nominal</td>
<td>12,522 MW</td>
</tr>
<tr>
<td>Gas</td>
<td>10,404 MW</td>
</tr>
<tr>
<td>Hydro</td>
<td>2,118 MW</td>
</tr>
<tr>
<td>Effective</td>
<td>7,139 MW</td>
</tr>
<tr>
<td>Gas</td>
<td>6,079 MW</td>
</tr>
<tr>
<td>Hydro</td>
<td>1,060 MW</td>
</tr>
<tr>
<td><strong>Peak demand - 2014</strong></td>
<td>12,800 MW</td>
</tr>
<tr>
<td><strong>Electricity access - 2014</strong></td>
<td></td>
</tr>
<tr>
<td>Non-electrified population</td>
<td></td>
</tr>
<tr>
<td>Overall</td>
<td>78.7 million</td>
</tr>
<tr>
<td>- Urban</td>
<td>20.7 million</td>
</tr>
<tr>
<td>- Rural</td>
<td>58.0 million</td>
</tr>
<tr>
<td>Non-electrification rate</td>
<td>40.2%</td>
</tr>
<tr>
<td>Overall</td>
<td></td>
</tr>
<tr>
<td>- Urban</td>
<td>21.6%</td>
</tr>
<tr>
<td>- Rural</td>
<td>60.7%</td>
</tr>
</tbody>
</table>

| Population density - 2016 | 204 hab/km² |
| GDP growth rate           | 4.27 %       |
| Annual - 2016             | -1.50 %      |
| Annual - 2017, exp.       | 0.80 %       |
| GDP/capita - 2016         | $ 2,176      |
| Growth                    | -4.10%       |
| Share of Oil&Gas products in |                          |
| State’s revenues - 2015   | 77 %          |
| Total exports - 2015      | 90%           |

Political environment, institutions and governance of the energy sector

Political environment

Major oil producer and Africa’s most populous nation and second-largest economy, Nigeria is a fragile economy recovering from years of economic crisis triggered by the 2008 plunge in oil prices. Despite its averred economic potential, the country remains plagued by high-level corruption, exclusive governance, political instability and cyclical legitimacy issues. While the election of M. Buhari in 2015 marked a milestone in Nigeria’s democratic development—the first peaceful transfer of power to a winner from an opposition party—there remains an urgent need to deliver reforms on economic policy and inclusive governance.

After decades of underinvestment in the energy sector, the Government of Nigeria has recently engaged into a pro-active energy policy addressing the major challenges facing the different segments of the electric power value chain. Among the key objectives of the government, this strategy aims at establishing a stable investment climate for private sector participation in the sector, expanding transmission and distribution networks to currently non-deserved customers, maintaining the bulk electricity trader as a creditworthy off-taker of electricity, establishing cost-reflective tariffs, and reducing inefficiency in support of affordable end-user tariffs.

Institutions and governance of the post-privatization power sector

To this end, Nigeria has embarked on the most ambitious electricity sector reform effort of any country in Africa, totaling more than $3bn of privatized assets. Initiated in 2001 with the National Electric Power Policy and further developed through the Electric Power Sector Reform Act of 2005, reforms unbundled the generation, transmission, and distribution subsectors; established the Nigerian Electricity Regulatory Commission (NERC) as independent regulator and the Rural Electrification Agency (REA) as official coordinator of energy access initiatives in rural areas; privatized power generation stations and distribution utilities; appointed a private management contractor to manage the national transmission company; and established the Nigeria Bulk Energy Trading (NBET) as bulk trader.

These reforms included in practice the dissolution of the National Electric Power Authority (NEPA), the creation of the Power Holding Company of Nigeria (PHCN) as a new holding company and the unbundling of the defunct integrated PHCN into a series of 18 successor companies – six generation companies, 11 distribution companies and a national transmission company, the Transmission Company of Nigeria (TCN). The privatization of PHCN’s successor companies, initiated in December 2010, is now complete (PwC, 2016 and KPMC, 2016).

The post-privatization structure of the Nigerian power sector is detailed in Annex 2.

Governance of rural electrification & prioritization of energy access in the political agenda

The energy access targets are defined in the Rural Electrification Strategy and Plan (RESP), designed by the Federal Ministry of Power in 2015, in the following terms: “The Federal Government of Nigeria has set an ambitious target: to make reliable electricity available to 75% and 90% of the population (rural or urban) by 2020 and 2030 and to reach at least 10% of renewable energy mix by 2025.” (RESP, 2015).
Despite the recent privatization program and the government’s attempt to clarify the governance of the power sector, **energy access remains a concurrent competency between the federal government and the states of Nigeria.**

In terms of responsibilities, the federal government defines national strategic objectives and regulates power generation and transmission **at grid level** while federal States have a mandate for off-grid areas, may be authorized to install new generating capacities within their boundaries by operating **Independent Electricity Distribution Networks (IEDNs)** and remain **minority shareholders of most privately-owned DISCOs** (GIZ, 2015).

In terms of coordination of activities, it officially falls to the **Rural Electrification Agency (REA)** to implement the legislation and act as the intermediary between the central Government, the federal States and the local governments. As defined in the RESP, the REA shall delegate financing issues to a hypothetical **Rural Electrification Fund (REF)** (GIZ, 2015).

Furthermore, most local States have a **State Rural Electrification Board** or a **State Electrification Agency** developing energy strategies at the state level. While the efforts of these local electrification agencies should be theoretically coordinated by the **Rural Electrification Agency (REA)** according to the EPSR Act of 2005, this is only rarely the case in practice (Eberhard et al., 2016).

In practice, a growing discrepancy is now appearing between the theoretical and **effective role** of local stakeholders in energy access. While the overall energy and electrification strategy remains the prerogative of the central government, the role and resources allocated to the States and rural agencies remains unclear and limited to punctual projects without overall coherence and planning. Officially created as part of the privatization Act of 2005 to support the development of off-grid electrification solutions, the Nigerian **Rural Electrification Fund** is still not operational (GIZ, 2015).

The natural conclusion of this section is that the **central government and NERC remain the main interlocutors of privately-owned DISCOs** often denouncing the **interference from local agencies and States** in decision-making processes.

**Demand analysis and consumer characterization.**

Nigeria has a per capita power consumption of only **151 kWh** per year, which is amongst the lower end of the spectrum in Africa, while the total national demand amounts to about 12.8 GW.

**Current status of the power demand**

As detailed in the figure below, individual households remain the main drivers of grid-connected electricity consumption. The available data on power consumption per sector in Nigeria reveal that – similar to energy consumption in general – the residential sector consumes around 65% of the distributed electricity. However, it is worth noting that these numbers do **not** account for captive generation from decentralized diesel and gas generators that are used in many industries and actually far exceed available grid-connected capacities. Due to recurrent power outages, around **96% of the industry’s electricity needs is self-produced** (RECP, 2016), which explains the relatively low share of electricity consumption of the industry sector in Nigeria, while also demonstrating the important potential of this market segment as potential “anchor loads” for future energy access initiatives, notably in rural areas.
Energy consumption has experienced a marked growth over the past decades, increasing from 12,500 kWh in 2005 to 17,000 kWh in 2010 until reaching an all-high level of 25,000 kWh in 2016. According to the latest studies in the field, both on-grid and off-grid demand for electricity may increase at an approximate rate of 13% per year over the ten coming years – therefore adding additional burdens to an already ailing power sector struggling to cope with current levels of consumption (KPMG, 2016).

**Current Status of Energy Access**

At present, Eberhard et al. (2016) estimates that **79 million Nigerians** lack access to reliable electricity supply, including 59 million living in rural areas. The overall electrification rate for Nigeria is just 45 %, an already decent score compared to the 32 % average electrification rate in Sub-Saharan Africa. However, there is a sharp discrepancy between cities and rural areas, as the rate of urban electrification in Nigeria is 55 % as compared to only 35 % for rural electrification. With the exception of a few southern local States, where most of the generation plants and distribution networks are located, little progress has been made in rural electrification or eliminating reliance on captive generators (Eberhard et Al., 2016).

Figure showing electricity access and planned grid access program for Kaduna Electric area

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2 Unstats.un.org/unsd/energy/edbase.htm
3 World Bank
According to the Rural Electrification Agency (REA), more than 1000 projects have been completed since 2005. However, limited (if any) details are available on capacity, the quantity of energy produced, or the number of consumers supplied. Likewise, no details are available on technology. The majority of these projects can be assumed to be grid extension initiatives (GIZ, 2015).

Electricity supply in the power sector

Once shining star of African economies, Nigeria is now recovering from a major economic recession. Dramatically low generation capacities and scarcity of sufficient and reliable electricity severely constrain the country’s economic growth and development and the privatization has not (yet) brought major improvements to the power sector.

Estimated at 12.8 GW in 2016, the national electricity demand outweighs by more than 50% an available capacity of around 8 GW\(^4\) for a population of about 190 million (Federal Ministry of Power, 2014 and Eberhard et al., 2016). Owing to poor operation and maintenance, aging generation and transmission infrastructure, fuel supply constraints and vandalism, Nigeria’s effective output rate per capita is among the lowest in the world and only 25% of Nigeria’s 12.5 GW of installed capacity effectively reaches the end user (Annex 1) (GIZ, 2015). The average number of hours of electricity supply per connected household was close to 6 hours per day over the 2013–2017 period\(^5\). However, this complex situation should not overshadow the positive signals sent by recent progress on the supply side.

Generation

The electricity supply chain largely comprises generation, transmission, distribution and retail. In line with its privatization efforts, the Federal government introduced range of new regulations in February 2016 to spur investment in power generation. These included a dollar-denominated Feed-in-Tariff with 20 year PPAs and a 50% renewable energy procurement goal for local DISCOs. Several hydro-projects are also under construction, soon adding an equivalent of 5 GW to the grid. Lastly, in 2016, the 450MW greenfield gas-fired power plant Azura-Edo raised the unparalleled amount of €745 million, providing a framework for project finance for Independent Power Producers (IPPs) in Nigeria.

While licenses are needed to operate a grid-connected generator, captive generation just requires a permit issued by NERC. According to the reform of October 2016, the deployment of mini-grids requires the double approval of NERC and the local DISCO operating in the State. However, off-grid electrification solutions can be developed without preliminary approval from any public structure (RECP, 2016).

Generation opportunities largely fall under captive generation, embedded generation, IPP on-grid, embedded electricity distribution network (IEDN), rural off-grid IEDN, and urban off-grid IEDN. Off grid generation covers small scale - up to 1MW - electricity generation for a single or limited number of customers; this category includes mini-grids. Of these seven options, NERC regulates the three largest options - captive generation (off-grid electricity entirely consumed by the generator itself

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\(^4\) Theoretically totaling 8 GW – in practice, effective peak production hardly reaches 5 GW (NERC, 2016)

with an installed capacity exceeding 1MW, with no upper limit), **embedded generation and IPP on-grid** (energy transmitted on the TCN grid).

**Grid-connected electricity generation**

Grid-connected electricity generation refers to the system where energy generated at power plants are transported on the grid for distribution to off-takers such as the Nigerian Bulk Electricity Trading company (NBET) supplying DISCOs.

In Nigeria, licenses for grid-connected power plants amount to 19,407 MW. Of this licensed capacity, approximately 13,000MW has been actually installed. The remainder 31% licensed capacity is not yet built or is under development. Of these 13,000 MW, approximately 6,000MW is available capacity and approximately 7,000 MW is non-operational, due to poor grid infrastructure and poor maintenance of the power stations. In 2015, 82% of the installed capacity came from gas and 18% from hydro (RECP, 2016).

Based on ownership, power plants in Nigeria can be classified as either:

- **National Integrated Power Project (NIPP)** owned by the Niger Delta Power Holding Company (NDPHC).
  
  In order to speed-up the deployment of new generation capacities, the Nigerian government embarked in 2004 on the **National Integrated Power Project (NIPP)** program, essentially using government funds to build ten gas-fired power plants **with the aim of selling them to private investors while retaining 20% of all assets**. There are currently 10 NIPPs, with a combined capacity of 5,455 MW (PwC, 2016).
  
  The NDPHC is owned by all three levels of administrative authorities (Federal, State and Local) currently co-existing in Nigeria.

- **Entirely publicly-owned or privately-owned projects**:
  
  o **Publicly-owned power plants** are local States-owned assets inherited from the former Power Holding Company of Nigeria (PHCN).

  As a preparation for the privatization, each power plant was incorporated as a single-asset generating company. Originally all government owned, these entities are now called “**PHCN Successor GENCOs**”. The six successor GENCOs account for a total capacity of 6200 MW.

  o **Privately-owned power plants**, or Independent Power Producers (IPPs), appeared in 2012 when NERC issued around 70 IPP licenses in order to improve the generation capacity in the country. The existing IPPs include Shell–Afram VI (642MW), Agip–Okpai (480MW) and AES Barges (270MW) (KPMG, 2016).
The figure above shows the geographic concentration of most generation assets in the south of the country, where population densities and ability to pay remain the highest.

Furthermore, only 31% of the installed capacity is effectively operational. As a matter of fact, grid-connected generation actors have faced significant challenges preventing the larger development of power production capacities necessary to limit power outages:

- **Unavailability of gas**: while 85% of Nigeria’s power production comes from thermal sources, gas availability is limited by high prices, pipe vandalism, insufficient gas treatment infrastructure and uncertainty in gas regulation and fiscal policy;

- **Inadequate electricity transmission infrastructure**: The existing electricity transmission system may only be capable of delivering about 5.300MW (out of the total installed capacity of 12.522MW) to DISCOs. TCN plans to upgrade the transmission system to a capacity of 11.000MW by 2020 (subject to adequate funding);

- **Liquidity issues**: since the privatization of government-owned assets in 2013, the generation sector has faced dramatic liquidity issues resulting from non-cost reflective tariffs and non-paying customers. Unable to collect sufficient revenues to cover their own electricity bills, DISCOs face a massive shortage of cash in the sector. This issue is a strong disincentive to investment in additional generation expenditure. The reform of the MYTO\(^6\) 2 tariffs (2012-2017) may not markedly change this situation.

- **The quasi-failure of the Nigerian Integrated Power Project (NIPP) privatization**: this process has been stalled for various reasons including gas shortage, drawn-out

\(^{6}\) 2\(^{nd}\) Multi-Year Tariff Order. It followed a first model (“MYTO 1”) implemented from 2008 to 2011.
negotiations, court actions and delays in executing gas supply agreements and investors remain reluctant to invest either debt or equity into the project given the high level of uncertainty and risks.

Not surprisingly, the number of issued generation licenses and the overall generation capacity (in MW) have been both declining since 2013. An exception is the number of ‘small’ (<100MW) renewable energy projects, as the number of issued licenses has grown from zero to four annually between 2011 and 2015.

As of March 2018, GENCOs had outstanding loans worth more than N1tr (around US$2.8bn).

Most of this debt is owed from NBET in accumulated debt (including interests) for power generated and supplied from 1st November 2013 till date. GENCOs may be receiving less than 20 percent of their invoices paid by NBET.

The accumulated debt largely reduces the GENCO’s ability to pay for gas – therefore exacerbating recurrent gas shortages - and operate their plants. The first power plant closures are expected to occur as of early 2018, thereby compounding the power generation shortage.

A N701bn Sovereign Payment Assurance Facility, created upon GENCOs’ request in March 2017, does not seem to be fully operational nor fully transparent in its application.

The worrying state of generation companies have led the Nigerian government to adopt as of May 2015 a directive allowing GENCOs to freely generate and sell electricity to end-users without having to partner with local DISCOs. This bill may allow GENCOs to secure their future cash flow, but also further compounds the shortage of power supply facing non-competitive DISCOs.

Captive generation

According to a 2013 survey, approximately 80% of the Nigerians use alternate sources of electricity supply such as diesel generators or solar PV. Estimates suggest that between 8 and 14 GW of decentralized diesel generator capacity are currently installed in the country, mostly for industrial purposes. With several millions of privately installed diesel generators, Nigeria remains Africa’s leading importer of diesel generators and one of the highest importers worldwide.

Based on the scarce information on all captive generation permits issued by NERC, the following can be concluded:

- 1,300 MW of permits for captive generation have been issued in total since 2010;
- 78% of these permits were issued in three industrialized and densely-populated States;
- No permits or licenses have been issued for renewable captive power.

Transmission

Nigeria’s transmission network consists of 159 substations with a total (theoretical) transformation capacity of around 19.000MW and 15,022km of transmission lines. 126 approved TCN projects worth approximately €1,2 billion are currently underway. However, delivery has been slow and only 22 of
these 126 approved TCN projects have been completed, primarily due to inadequate funding (ongoing FGN funded projects are generally ineligible to access external funding reserved for new projects) and the lack of bankable projects.

The neutral role of grid owner is played by the Transmission Company of Nigeria (TCN), a state-owned company which manages grid assets on behalf of the Nigerian government. The TCN is a successor company of PHCN and was being managed for four years (2012-2016) by a Management Contractor, Manitoba Hydro International - a subsidiary of an electric and natural gas Canadian utility. Manitoba is responsible for revamping TCN towards higher technical and financial standards in addition to providing stable transmission of power without system failure. The federal government has taken over the management of TCN in July 2016.

The operation of TCN includes the key three functions of market operator (MO), system operator (SO) and transmission service provider (TSP). Governmental plans are to separate the TSP entity from the MO and SO in order to privatize (partially or entirely) the company in the medium term (KMPG, 2016). Potential business opportunities in the transmission sector may thus arise in the short or middle run, with the advantage of providing significant benefits to current and future actors of the generation and/or distribution sector(s).

Distribution

Distribution companies perform the dual task of transporting energy from local distribution injection points to customer locations, and also serving as the energy retailer by selling electricity directly to customers. This integrated style of distribution is particularly unique to the power sector in many African countries.

As part of the privatization process, the distribution network was broken up into 11 regional grids operated by local DISCOs partly sold off to local and foreign investors. A minority stake of the DISCOs was retained by the government of Nigeria. The privatization of the distribution sector was performed through a competitive bidding process and completed in November 2013.

The two structural challenges faced by local DISCOs are the very high levels of ATC&C (Technical, commercial and collection) losses experienced by these companies and the lack of cost-reflective tariffs, jeopardizing the DISCOs as well as the rest of the electricity value chain:

- **Distribution losses**: While bidding processes organized as part of the privatization were based on predefined levels of losses made available to investors by the Nigerian government, actual losses have proven to be much higher than advertised and have contributed to the precarious financial state of current DISCOs. According to the latest data available, DISCOs are currently experiencing levels of distribution losses as high as 46% - including technical (12%), commercial (6%) and collection (28%) losses.

- **Electricity tariffs**: Despite several structural reforms undertaken as part of the privatization process, Nigeria’s power sector still suffers from inadequate and unstable electricity pricing weighting on the viability of the entire power sector.
As detailed in the tables below, the resulting distribution companies vary greatly in terms of network size, number of customers and geographic area. In practice, very little information on the state and management of these companies is publicly available.

<table>
<thead>
<tr>
<th>AREA</th>
<th>NUMBER OF CUSTOMERS (’000, 2014)</th>
<th>DISTRIBUTION NETWORK (KM, 2008)</th>
<th>ALLOCATION (% OF GRID ENERGY)</th>
<th>ACTUAL AVERAGE (JAN 14 – APR 15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABUJA</td>
<td>755</td>
<td>107.254</td>
<td>12%</td>
<td>15%</td>
</tr>
<tr>
<td>BENIN</td>
<td>1,187</td>
<td>104.702</td>
<td>15%</td>
<td>14%</td>
</tr>
<tr>
<td>EKO</td>
<td>581</td>
<td>8.093</td>
<td>13%</td>
<td>13%</td>
</tr>
<tr>
<td>ENUGU</td>
<td>819</td>
<td>25.078</td>
<td>9%</td>
<td>12%</td>
</tr>
<tr>
<td>IBADAN</td>
<td>1,750</td>
<td>24.355</td>
<td>5%</td>
<td>11%</td>
</tr>
<tr>
<td>IKEJA</td>
<td>1,128</td>
<td>12.466</td>
<td>11%</td>
<td>9%</td>
</tr>
<tr>
<td>JOS</td>
<td>466</td>
<td>12.227</td>
<td>8%</td>
<td>8%</td>
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<tr>
<td>KADUNA</td>
<td>459</td>
<td>26.653</td>
<td>7%</td>
<td>7%</td>
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<tr>
<td>KANO</td>
<td>598</td>
<td>21.041</td>
<td>6%</td>
<td>5%</td>
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<tr>
<td>PORT HARCOURT</td>
<td>557</td>
<td>17.989</td>
<td>8%</td>
<td>5%</td>
</tr>
<tr>
<td>YOLA</td>
<td>345</td>
<td>6.505</td>
<td>4%</td>
<td>2%</td>
</tr>
</tbody>
</table>

The precarious financial situation of Nigerian DISCOs triggered the launch, as of 2014, of a USAID/Power Africa-backed technical assistance program targeted at four of the most endangered companies. Building on a 2013 reverse trade mission with Nigeria’s newly privatized distribution companies (DISCOs), USTDA is currently providing project preparation assistance for the Eko, Ikeja and Benin DISCOs, to support modernizing their networks and reducing technical and commercial losses, as well as identifying ways to increase collections. USAID has additional advisors working in the Abuja, Benin and Eko DISCOs to address management challenges. The implementation of metering may improve bill recovery in the short term.

In the absence of structural reforms and the introduction of truly cost-reflective tariffs, no long-term improvement can be expected in the distribution sector.

The financial situation of DISCOs is rapidly worsening. Local DISCOs had a joint debt totaling N700bn (around US$ 1,95bn) in March 2018, a 25% increase from N 562bn (around US$ 1,6bn) in October 2017 and 332% increase from N 162bn (around US$ 450m) in March 2016.

In January 2016, several DISCOs announced they were on the brink of defaulting on their debt to NBET and the Market Operator. This triggered the aforementioned NERC-led reform attempt of MYTO in February 2016, but improvements have remained minor to date.

In practice, DISCOs are paying less than 20 per cent of what they should remit to the bulk trader for onward payments to producers of electricity and gas suppliers, thereby destabilizing the entire power value chain.
Current DISCOs have the mandate and obligation to extend the grid to previously unserved regions. However, given the substantial financial investment required to upgrade the existing network infrastructure, in the absence of supportive federal financing structure, DISCOs mainly focus on consolidating their existing customer base and extending the grid in their most profitable areas of operation.

DISCOs have long been forbidden to establish and operate generation capacities. Consequently, their role in off-grid electrification has traditionally been limited to operating small-scale independent distribution networks, which under the present conditions are not deemed as priorities (GIZ, 2015).

The situation may however have changed in February 2017 with the publication of a regulation for mini-grids. Aiming at accelerating electrification in areas without existing distribution network or with an existing but poorly electrified or non-functional distribution grid, this regulation allows DISCOs to develop and exploit grid-compatible mini-grids of less than 1 MW at cost-reflective tariffs within their own “underserved areas”.

**Tariff Remuneration in the Electricity Sector**

Electricity tariff design in Nigeria is determined under the “Multi Year Tariff Order” (MYTO) model aiming at providing a unified framework to determine total industry revenue requirement and a 15-year tariff path for both wholesale and retail prices. The Nigerian Electricity Regulatory Commission (NERC) oversees tariffs and remuneration of the distribution companies. Under MYTO DISCOs can submit applications for tariff reviews for review and approval and/or amendment by NERC. Minor tariff review occurs biennially with tariffs adjusted based on exchange rates, gas prices, rates of inflation and generation capacity.

As part of MYTO 2 and per supposed requests from industry stakeholders, it was announced that fixed charges had been removed from the tariff design leaving in place an energy (naira/kWh) charge. Additional amendments included a review of projected ATC&C loss reduction benchmarks for each DISCO to better reflect actual losses and a reinstatement of regular upward adjustments of tariffs for all customers with the exception of lifeline (low-income) customers. However, despite two successive reforms of the MYTO system, electricity tariffs remain far below cost recovery levels. The grid-based power prices averaged at less than a half of the generation costs (end-user tariffs: €0.11-0.16/kWh vs. generation costs: €0.27 – €0.41/kWh) until a reform attempt early 2016 (RECP, 2016).

Multiple complaints from DISCOs and GENCOs led the regulator to proceed to a 45% increase in electricity prices as of February 2016 in order to better cover the cost structure of power producers and distribution companies (NERC, 2016). However, this tariff increase was declared illegal by the Federal High Court in Lagos on July 13, 2016. Backed by the Nigerian Ministry of Power, NERC has decided to file an appeal against the decision.

**MYTO Tariff Methodology**

MYTO sets tariffs for all parts of the power sector – generation, transmission and distribution (wires and retail). Per NERC, distribution and retail will be separated once the industry becomes more competitive (NERC, 2008). Currently, the market operator (under TCN) operates electricity payment with the DISCOs. The DISCOs pay the MO for energy and transmission and the MO pays the generators and TCN for their services (NERC, 2008). NERC sets revenue requirements for the DISCOs with annual allowances for capital expenditure, operation, maintenance, administration, metering
and billing. In determining this revenue requirement, NERC sets limits on allowed technical and non-technical losses. As previously mentioned, in MYTO-1, actual ATC&C losses were substantially higher than the numbers used to determine the revenue requirement and resulted in huge losses for the DISCOs. This revenue gap affected payments to generators and TCN and effectively bankrupted the sector. Updated losses in MYTO-2 might still be too optimistic and this, paired with the expected ramping up in investment in expanding access and improving metering and billing have resulted in an unsustainable situation.

Outside of the much-discussed distribution/retail revenue requirement calculations, there is cross subsidization of tariffs under MYTO. This tariff equalization was introduced given the fact that distribution and retail costs vary considerably across states depending on the population density, geography and other factors. Consequently, the tariffs are determined in aggregate, and there is redistribution of collected revenue between DISCOs. Additionally, the lowest income customer class are exempt from upward changes in tariffs (NERC, 2008, pg. 29).

NERC regulates tariffs in the power sector under the Multi-Year Tariff Order. It sets revenue requirements for the DISCOs with annual allowances for capital expenditure, operation, maintenance, administration, metering and billing.

Past attempts to increase tariffs to cost-recovery levels have either been severely watered down, abandoned or declared as illegal by the Nigerian Federal Courts.

Tariffs are kept uniform across the country through cross-subsidization payments between DISCOs.

Decentralized and off-grid electrification initiatives

Decentralized and off-grid electrification initiatives remain marginal but emerging models may change the current dynamics of rural electrification. While a series of companies and NGOs has installed 115 MW of off-grid photovoltaic combining mini-grids and stand-alone systems, most of these projects were financed with grants from international donors or the federal, state and local government and their sustainability is still to be proved (GIZ, 2015).

Analysis of the mini-grid sector

The development of mini-grids has remained at the embryonic stage in Nigeria due to unfavorable regulation imposing developers to operate under the MYTO system. This obligation has deterred private investors from getting involved in the sector, MYTO being designed for national grid-based projects and thus particularly ill-suited to mini-grids subject to high initial and operating costs.

The reform of the mini-grid sector now allows mini-grid developers to operate under cost-reflective tariffs designed on an ad-hoc basis. However, new administrative rules imposed by this new regulation may deter the private sector from getting involved in the sector as developers may now have to submit a permit request both to NERC (as it was the case before) and to the local DISCO in charge of the “underserved area” where the mini-grid would be developed. Furthermore, developers now are requested to purchase the land of the mini-grid installation before applying for a permit – which adds an additional risk to the project.
Per NERC’s 2016 mini-grid regulations, mini-grid operators must pay network usage charges to DISCOs. These charges will be agreed bilaterally or failing an agreement between the parties, by applying a guideline predetermined by NERC. Additionally, the MYTO methodology must be used by mini-grid permit holders to determine retail tariffs while mini-grid operators can set retail charges in accordance with MYTO or alternatively through agreements with the community set to benefit. In this latter case, bilateral agreements must occur with at least 60% of the community.

While this new regulation may prevent small mini-grid developers with little capital available from engaging into new projects in Nigeria, it is worth noting that the new framework for mini-grids would actually benefit companies developing integrated distribution models, at least for the two following reasons:

- Mini-grids may now operate under cost-reflective tariffs, as opposed to national grid-based projects;

- The integrated distribution company is actively looking for mini-grid projects (whether in-house or through an external partner), while traditional DISCOs may see mini-grid developers as direct competitors and thus potentially delay approval proceedings on their own territory;

Prospects for solar off-grid electrification

**State of the PAYG solar sector**

Prospects for off-grid electrification in Nigeria are impressive. While 55% of the population may live without access to electricity, decent 2G coverage opens unparalleled opportunities for PAYG solar-based electrification initiatives in the country. According to the GSMA (2016), the total addressable market in Nigeria may amount at 70 million people.

Mirroring trends initiated in East Africa, a handful of “pay-as-you-go” solar companies have recently entered the Nigerian market. Most importantly, the Dutch company Nova Lumos (now Lumos Global) has sold SHS to more than 3,000 Nigerian households. The start-up raised around USD 100 million to date, including $50m of debt funding from OPIC in December 2016 - as part of a $90m funding round, which still remains the largest ever investment in off-grid solar to date.

What is more, leading east-African PAYG solar companies have recently entered the Nigerian market or consider doing so. The British company BBOXX has recently partnered with the local distributor Pan African Solar to diffuse PAYG solar technologies in Nigeria. The first operational branch was opened in May 2017 in Kano, in the northern part of the country. Successful PAYG solar service providers, such as Mobisol, M-KOPA and Fenix International, which have grown out of East Africa, are now exploring opportunities to replicate their models in West Africa (GSMAa, 2016).

While significant business opportunities arise from the huge market size for SHS in Nigeria and the end of public subsidies on kerosene, endemic corruption, highly volatile exchange rates and uncertain regulatory framework may affect the development of solar-based electrification models (GSMAa, 2016).
State of the mobile communication and mobile money sectors

A critical enabler for PAYG solar is the uptake of mobile phone communication and money services to unlock customers’ ability to make small payments through their mobile phone. Both have proved to act as main limiting factors to the development of PAYG solar technologies in Nigeria.

As in many western and central SSA countries, limited mobile phone adoption rates and network coverage may affect the potential of PAYG SHS in peri-urban and rural areas. Nigeria is characterized by a decent 2G coverage (87.2%) - with the exception of remote areas in the very east and north - while 3G coverage is concentrated in urban centers and covers only 50.84% of the population. While population coverage is extensive, market penetration by unique subscribers is just 47% and only 86 million Nigerians own a mobile phone.

The diffusion of mobile money remains limited and may pose significant problems to the development of solar-based electrification initiatives in Nigeria. Adoption rates are currently lagging behind East African markets but may experience strong growth in the next coming years. 19 licensed mobile money service providers are currently operating in the country. Despite having the highest number of mobile money service providers in the world, there are just under 13 million mobile money accounts – a modest number compared to the total population of about 190 million people. The number of mobile money accounts in Nigeria increased from 5.7 million in December 2013 to 13 million early 2016. While not yet as strong a mobile money market as East Africa, these figures show that the market potential is beginning to materialize.

In practice, the diffusion of mobile money is largely constrained by ill-suited regulatory frameworks enforced by Central Bank of Nigeria. By restricting mobile financial services to bank-led models, current frameworks specifically exclude MNOs from providing mobile financial services and limit their role to solely the provision of the channel through which other providers’ mobile money services can be offered. This situation has invariably resulted in under-investment in mobile money by MNOs and limited customer adoption levels. The limited reach of bank-led mobile money services constrains the opportunity for PAYG solar to scale. Alternative models may be needed in order to facilitate the financing of PAYG solar home systems for off-grid customers. Lumos proved that airtime credit could be successfully used as an alternative means to collect payments for its energy service. On the upside, mobile subscribers’ familiarity with airtime reduces the need for customer education. However, the technology integration is significantly more complex for airtime than for mobile money (GSMAb, 2016).

Thus, Nigeria may offer significant business opportunities for off-grid PAYG solar-based electrification. Several leading PAYG solar companies have paved the way for unparalleled electrification prospects in underserved regions on market terms. While the Nigerian market may prove to be significantly more complex than East Africa’s, innovative digital payment models may allow PAYG solar companies to overcome the most important obstacles to large-scale solar-based energy access in peri-urban and rural regions.

PAYG solar may thus represent a credible alternative and complement to national grid or mini-grid electrification. The wide range of services offered by incumbents allows new entrants to enjoy a large choice of possible local partners and/or acquisition targets.
Business opportunities for integrated distribution companies in Nigeria

While the current regulatory framework does not allow the development of financially sustainable integrated electrification approaches, structural reform in electricity tariffs may soon pave the way for unprecedented business opportunities in both generation and distribution. From a governance standpoint, the flexibility of current regulations already allows DISCOs, mini-grid developers and PAYG solar companies to operate within the same area and to coordinate grid management and extension activities with the deployment of mini-grids – by the DISCO or a partner company - and the diffusion of PAYG SHS – by a partner company only.

Viability of integrated distribution business models: constrains and limiting factor

Ill-suited regulations and the worrying state of the Nigerian power sector as a whole may affect the feasibility and viability of integrated distribution business models. Heavy investments in infrastructure modernization and bill recovery will be necessary in order to ensure the viability of national grid-based power distribution, and most notably in underserved regions of northern Nigeria. Mini-grids may constitute an interesting alternative to national grid-based electrification programs in peri-urban or densely populated rural areas, but careful attention should be paid to current ambiguous regulations pertaining to permit issuance and electricity tariff setting. Taken separately, PAYG solar remains by far the most promising option, and the presence of at least two leading companies in Nigeria offers unparalleled opportunities for large-scale electrification.

Furthermore, regulation remains evasive and unclear concerning (i) the possible unbundling of distribution and retail activities and (ii) the ability of DISCOs to engage into the deployment of PAYG SHS within their “underserved area”. Regulatory arrangements do not explicitly allow for the unbundling of distribution and retail and consider both services as a single activity undertaken by DISCOs. In practice, the Electric Power Sector Reform Act of 2005 provides that the regulatory commission will unbundle the distribution segment of the electricity industry and allow for competition by licensed firms in the next coming years, but no concrete action in this direction has been undertaken by the regulator yet. What is more, the possibility for local DISCOs to undertake energy access initiatives via PAYG SHS remains unclear due to the lack of specific policies and regulations for off-grid solar. While the sector remains unregulated to date, the ability of DISCOs to engage into this sector remains unclear to date (Dalberg, 2017).

At the end of the day, the adoption of transparent and cost-reflective electricity tariffs appears as the most critical condition for any private actor to engage into integrated distribution business models and invest in supporting generation assets. Although unlikely to occur in the very short term, structural reform in electricity prices could dramatically affect the viability of the Nigerian power sector and allow for unprecedented profitable business opportunities in the sector, from power generation to off-grid distribution.

Overall involvement scheme

Nigeria’s current regulations already allow for the development of integrated (but not financially sustainable) electrification frameworks conciliating grid extension activities, the deployment of mini-grids and the diffusion of PAYG SHS within the same State(s). Provided that adequate cost-reflective electricity tariffs have been adopted by the Nigerian government, multinationals interested in the development of integrated power distribution companies in Nigeria should consider:
1. **Taking over grid-based electrification initiatives by acquiring a local DISCO;**

   By acquiring the DISCO, the multinational company will also acquire (i) the *exclusivity over national grid extension initiatives* and (ii) *approval rights over the deployment of mini-grids* within the DISCO’s legal area of operations (or “underserved area”).

   USAID-backed Abuja, Benin and Eko DISCOs seem to be promising targets.

   **Note** - The DISCO has *no* approval right over PAYG solar companies willing to operate within its own area of operations;

2. **Spearheading the development of mini-grids in the DISCO’s “underserved areas”;**

   Two different paths may be considered:
   i. Mini-grids could be designed, implemented and operated by the DISCO itself;
   ii. Mini-grids could be designed, implemented and operated by an external partner company that shall get the approval by the DISCO;

3. **Spearheading the diffusion of PAYG SHS in the DISCO’s “underserved areas”.**

   Since DISCOs are not allowed to operate off-grid (PAYG) SHS, this activity should be pursued by a partner company.

   What is more, current regulations do not give DISCOs any particular approval right over the diffusion of PAYG SHS within their “underserved area”. Multinationals may thus consider acquiring a PAYG solar company in order to have full control over the diffusion of PAYG SHS and hence ensure overall consistency between grid extension, mini-grid deployment and PAYG SHS diffusion within the DISCO’s area of operation. Nova Lumos and BBOXX may be interesting targets.

4. **Further expand its activities to other local States by acquiring other DISCOs**
Annex

Annex 1 – Nigeria Power Sector Energy Flow


Annex 2 – Structure of the Post-privatization power sector

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