AllON

Energy innovations.
Powerful collaborations.

Impact Energy: Case Studies of Successful Off Grid Energy Businesses in Nigeria

In collaboration with

REA

RURAL ELECTRIFICATION AGENCY

ENERGY=EMPOWERMENT=EFFICIENCY

Research conducted by

pwc

Contents

1

Executive Summary

One of the key objectives of the Nigerian Power Sector Reforms is to stimulate the development of off-grid energy projects to complement the grid particularly to rural areas where it is not cost-effective to supply power from the grid.

This study examines successful off-grid clean power projects in Nigeria, highlighting their history, operating model, success factors, impact and lessons learnt for the industry. The study was conducted through field research involving site audits and interviews of project owners, customers and other stakeholders.

Furthermore, the companies studied supplied a total of 60.6MW of off-grid electricity to urban and rural areas, residences, small businesses and large industrial customers across Nigeria utilizing solar, biomass, hydro and gas sources. The companies studied are:

Nigeria Electricity Supply Corporation
West Africa's first renewable energy company providing electricity to rural communities, small businesses, and commercial and industrial customers in Plateau State, Nigeria since 1929.

Green Village Electricity
Nigeria's largest solar mini-grid provider supplying electricity to off-grid rural communities in six states across Nigeria.

Presco
One of Nigeria's largest agri-businesses specializing in palm oil production. Presco uses bio-waste from its production to generate biomass power for self-consumption.

Bonny Utility Company
A utility company established by large oil and gas corporations to provide power to host communities in the Niger-Delta.

Alausa Power Limited
A Public-Private Partnership (PPP) established to provide power to government facilities and public utilities in Lagos.

Lumos
A Solar Home System company providing power to thousands of households and SMEs across Nigeria

EEI
A government initiative aimed at providing electricity to Micro, Small and Medium scale Enterprises in economic clusters across the country

2

Key Lessons from the case studies

1 Location

Off-grid energy projects are best situated where input fuel is readily available. The solar mini-grids are situated in parts of the country with high solar radiation and an average of five sun-hours daily. Industries can also use the bio-wastes from their production process as input fuels for captive power generation. Proximity to reliable gas supply is also key for gas power generation.

2 Community Relations

Community engagements are essential for getting stakeholder buy-in and building a strong sense of ownership from community dwellers. A common practice among successful off-grid businesses is to employ locals as site maintenance and security officers. This serves as a means of job creation and knowledge transfer while stimulating customer interests and ensuring the security of the site and project assets.

3 Funding

In addition to the guarantee of consistent power supply, cost is a key consideration for the adoption of alternative energy sources. For off-grid power generation to be attractive to customers, the cost of use should at least be cheaper than the cost of captive power generation from fossil fuel oils. Successful off-grid businesses rely on low-cost patient capital to enable them to provide services to customers at affordable rates and spread profits over a long period.

4 Partnerships with OEMS

Partnerships with Original Equipment Manufacturers (OEMs) help acquire installation and maintenance materials at low cost. This helps reduce capital and operating expenditure and to improve overall project economics.

5 Corporate Governance

While most off-grid businesses in Nigeria, especially the mini-grid players, are at the start-up stage, those with good corporate governance are able to attract needed investment and partnerships for scaling in the industry.

6 Technical Capability

Companies with strong technical capabilities are able to carry out installation and after-sales support of their equipment by themselves. This helps the companies make huge savings in capital and operating expenses. It also enables the companies to respond swiftly to technical issues on site thereby reducing downtimes in operations.

7 Maintenance Culture

A strong culture of maintenance is important for the long-term sustainability of off-grid energy operations

3

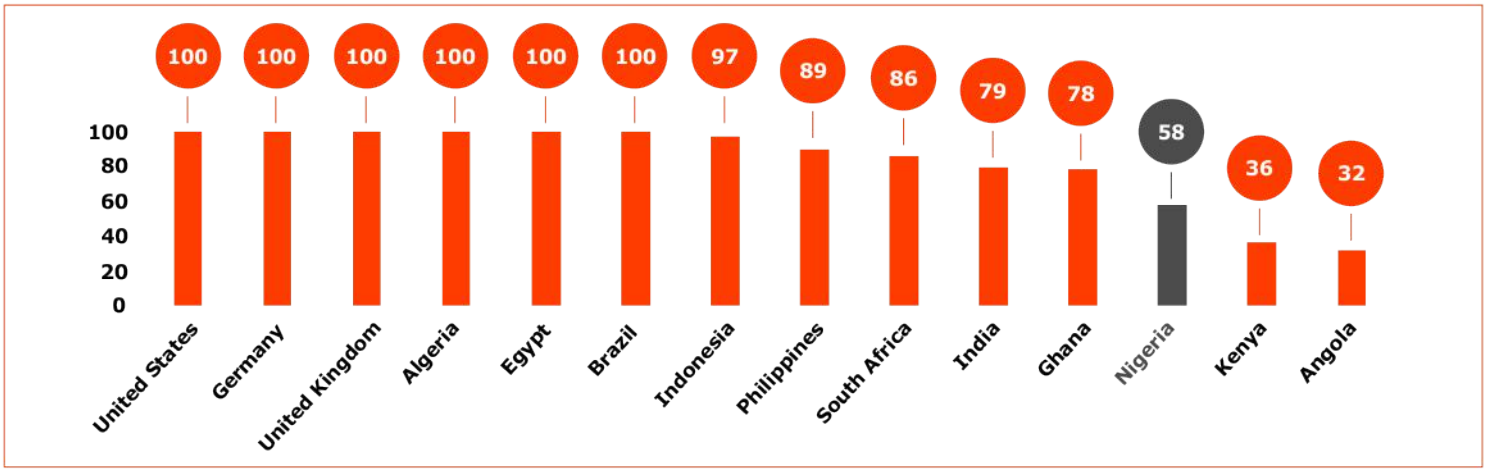
Overview of the Power Sector in Nigeria

Although Nigeria is an energy-resource-rich nation, it is an energy access poor country with its electricity supply chain plagued with significant challenges.

Nigeria has an installed electricity generation capacity of 12,522MW. However, due to poor infrastructure, peak electricity generation stands below 5,000MW (less than 40% of installed capacity). About 20% of the generated electricity is constrained and cannot be transmitted to power stations. A further 8-10% is lost in transmission and distribution. This has led to a low per capita electricity consumption of 144kWh with 40% of the population and 18m households with no access to grid-connected electricity and a further 9m households with less than four hours of grid power per day.

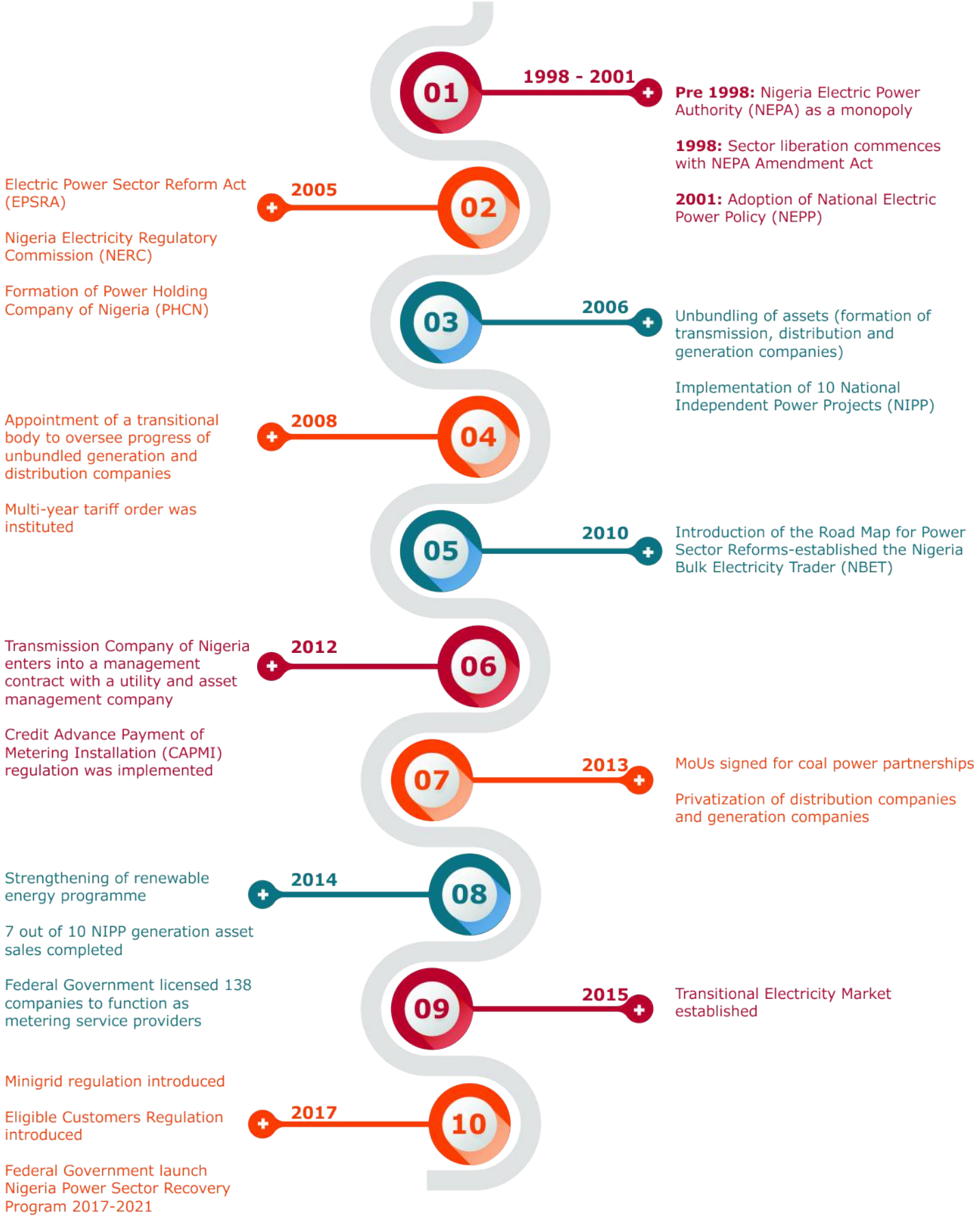
Electricity Consumption (kWh Per Capita)

Electricity Access (%)



Before 2005, the National Electric Power Authority (NEPA) was the sole provider of grid electricity in the country. Nigeria Electricity Supply Company (NESCO) was the only other company allowed to provide electricity for areas in the Northern region of the country

In 2005, NEPA was renamed Power Holding Company of Nigeria (PHCN) and its assets were decentralized into generation, transmission, and distribution companies. In 2013, PHCN was privatized leading to the formation of 6 generating companies (GENCOs), 11 distribution companies (DISCOs) and the Transmission Company of Nigeria (TCN). The latter remained fully government owned.



The three main subsectors that cover the activities of the on grid power sector include:

The generation subsector has 23 grid-connected generating plants with a total installed capacity of 12,590 MW, and an average generation of 4,200MW. The GENCOs supply the electricity they generate to the DISCOs through the TCN. GENCOs are also allowed to supply electricity to bulk customers who consume more than 2MW of electricity under the eligible customer regulation. The Federal Government has fully divested its interest in five of the power generation companies –Afam Power Plc, Sapele Power Plc, Egbin Power Plc, Ughelli Power Plc, Shiroro Power Plc –While Kainji/Jebba Power Plc was concessioned.

The Transmission Company of Nigeria (TCN), owned by the Federal Government, is the link between on-grid power generation and distribution in Nigeria. It receives power generated from the GENCOs and transmits to the DISCOs. The TCN network consists of substations with 7,500 MW installed transmission capacity and average wheeling capacity of 5,300MW. TCN operates 20,000 km of transmission lines.

The distribution companies are the last mile in the on grid electricity supply chain in Nigeria as they are responsible for electricity supply to the endcustomers. DISCOs step down the electricity supply from the high voltage of transmission level (132kV) to distribution levels (33kV/11kV/0.415kV) depending on the client's demand and grouping. Each DISCO has a power distribution franchise to operate in specific regions of the country. The government owns 40% of the shares in DISCOs while the private investors own 60%.

12,522MW
Installed Capacity

4,200MW
Generation

8,322MW
Not Utilised
Capacity Losses

5,300MW
Transmission Network Operational Capacity

... but only transmit
3,900MW
300MW
transmission Losses due to:
1. Load Rejection Issues
2. Poor Transmission Inrastructure

Transmission

3,500MW

Distribution Losses
400MW
distribution Losses due to:
1. Poor Distribution Infrastructure
2. Electricity Theft

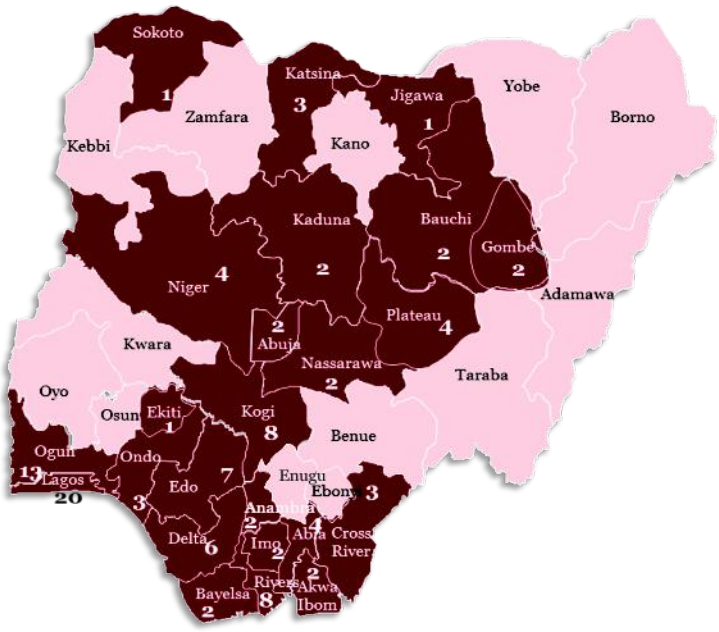
Distribution

15,730MW
Estimated Demand

3,500MW
Supplied

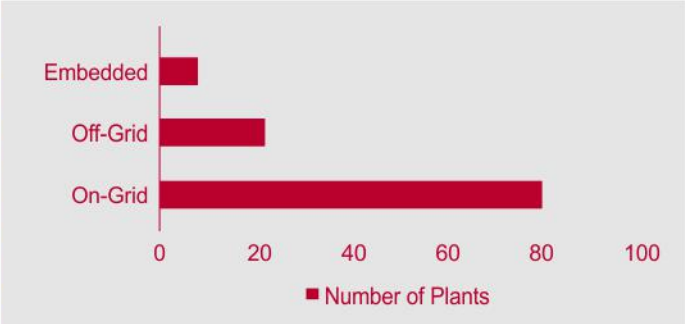
12,230MW
Demand Unmet

There are 111 licensed power plant across the country



Source: Nigerian Electricity Regulatory Commission, PwC Analysis

Type of Power Plants



33,637MW Licensed On-Grid plants

29 Operational On-Grid Power Plants

12,590MW Installed Capacity On-Grid Power Plants

735.5MW licenced Off-Grid and Embedded Power Plants

11 Operational Off-Grid Power Plants

332.87MW Operational Capacity of Off-Grid and Embedded Power Plants

Other key players in the on-grid power supply chain include:

National Independent Power Projects (NIPP)

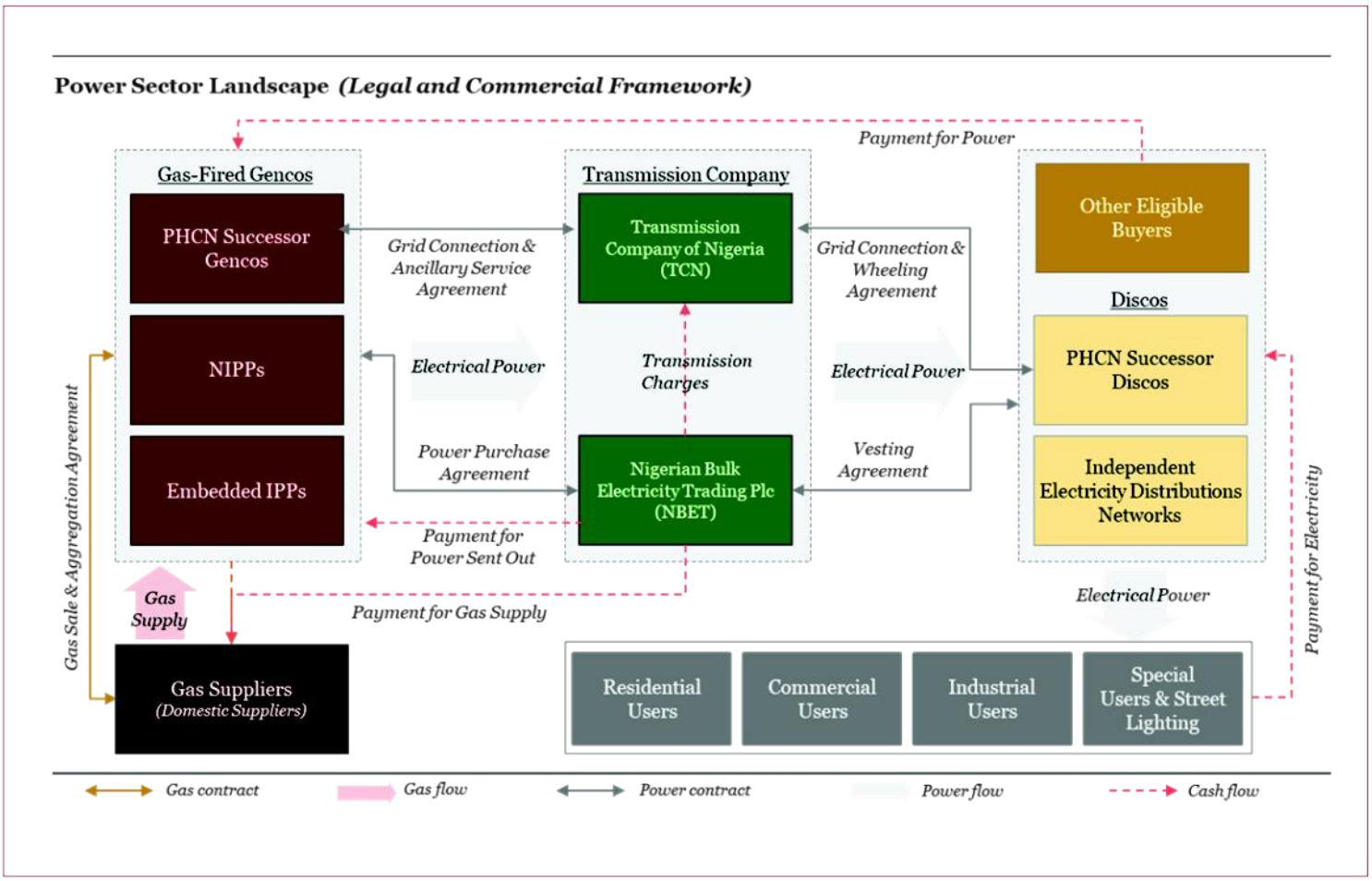
NIPP is a government intervention effort to boost electricity supply. NIPPs are fully integrated projects with generation, transmission and distribution infrastructure to generate transmit and distribute electricity to customers. NIPPs are managed by the Niger Delta Power Holding Company (NDPHC). NDPHC has 10 new gas-fired power stations with an installed capacity of 5,397.8MW.

Nigeria Bulk Electricity Trading Plc (NBET)

NBET was set up to purchase power generated by the GENCOs and IPPs at agreed prices and resell to the DISCOs at a set tariff.

Nigeria Electricity Regulatory Commission (NERC)

NERC was established by the Electricity Power Sector Reforms Act of 2005 to regulate the electricity industry. NERC is mandated to issue licenses to industry players across the value chain, define industry codes and standards, and set cost reflective industry tariffs.



4

Overview of the Off-Grid Energy Sector in Nigeria

Grid power supply is able to meet less than 25% of the current estimated 15,730MW power demand in Nigeria. To bridge the energy access gap, residential users often rely on self-generation powered by petrol, diesel and other fossil fuel sources. Commercial and industrial customers also use diesel generators for captive power generation to meet their energy demands due to the unreliable power supply from the grid. Power generation from these dirty fuel sources are expensive and inefficient and come with environmental consequences while still not guaranteeing reliable power supply.

The Nigerian government has taken several steps to reform the Nigeria Electricity Supply Industry (NESI) by addressing the bottlenecks in the power supply chain and decentralizing power supply. One of such steps is the establishment of frameworks for captive power, embedded power and rural electrification (mini-grids) through the Nigerian Electricity Regulatory Commission (NERC).

Since the establishment of the framework, NERC has licensed over c.740MW of off-grid and embedded power plants with the operational plants providing c.350MW of electricity to residential and commercial customers across the country. These power plants utilize alternative sources of energy (gas, hydro, solar and bio), which are cheaper in the long run, and more environmentally friendly than the more prevalent liquid oil sources such as diesel and petrol.

The use of alternative energy sources for power generation is not entirely new in Nigeria. The first renewable power plant in West Africa was built by tin mining campanies in 1923 and later taken over by the Nigerian Electricity Supply Corporation (NESCO), to provide power for mining activities and off-grid rural communities in the old Benue-Plateau region.

The sector reforms have led to the emergence of the clean off-grid power generation in the form of:

Captive Power

Power generated for self-consumption. It is mostly used by commercial and industrial customers with heavy power needs. Such commercial and industrial customers mostly use gas, biomass and solar for power generation. Captive power does not require distribution infrastructure and only requires a permit from NERC if power generation is above 1MW.

Off-grid Independent Power Plants (IPPs)

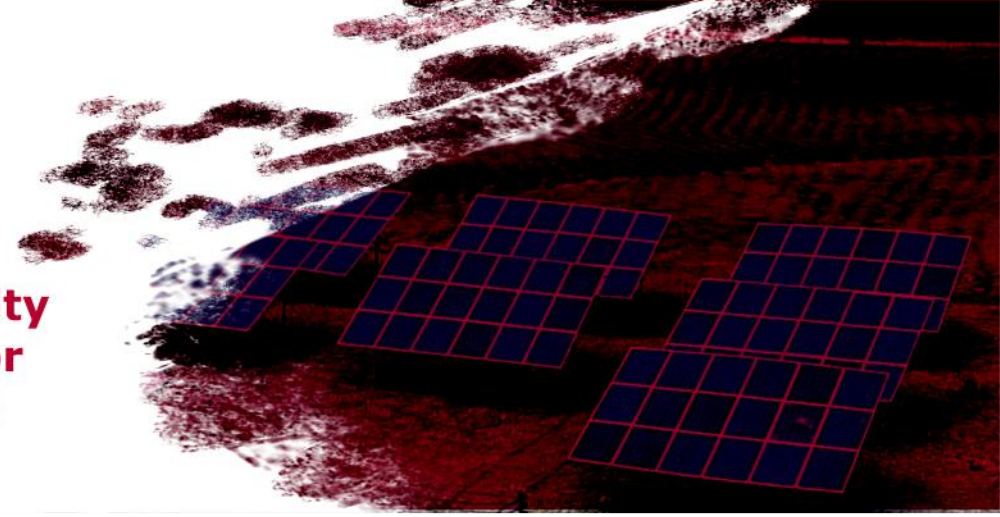
Power generated and sold to residential or commercial off-takers like housing estates and industrial clusters. IPPs sometimes require distribution infrastructure depending on the distance/coverage of their power supply. IPPs are typically gas-based power generation –thermal and direct combustion –and are mostly over 1MW in capacity due to the demands of their customers. IPPs require licenses from NERC for their operations.

Mini-Grids

These are usually Independent Electricity Distribution Networks (IEDN) in rural areas with less than 20,000 dwellers who are not connected to the grid. Mini-grids can help to serve the 40% of the Nigeria population without access to electricity, who are mostly concentrated in remote rural areas. Mini-grids in Nigeria are mostly solar-powered with less than 1MW installed capacity per site, and those distributing less than 100kw of power do not require licenses from NERC for their operations.

Solar Home Systems

Standalone solar systems installed on rooftops of houses to meet the basic electricity needs of households. They are also used for self-consumption by micro and small enterprises. In Nigeria, solar home systems are mostly off-grid and they are installed with battery banks to provide backup power at night and during power outages. While households in urban communities use solar home systems as an alternative to the grid, those in off-grid and undeserved communities use them as their main source of power supply.



5A

Green Village Electricity (GVE): Solar Power for Off-grid Communities

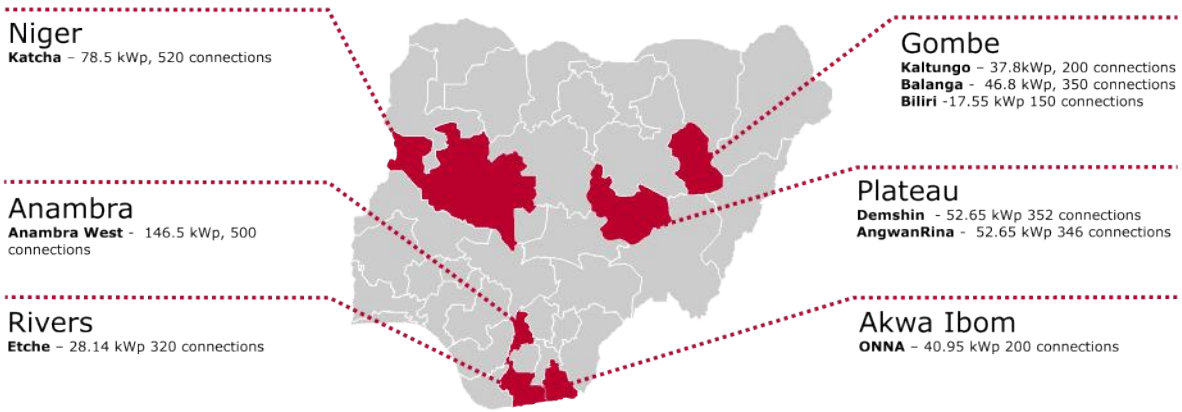
History

The trio of Ifeanyi Orajaka, Chuka Eze and Ikechukwu Onyekwelu first conceived the idea of GVE in 2009 as undergraduates at the Federal University of Technology Owerri. Traveling back at night from inspections of oil field facilities while interning at an oil and gas company, they observed the poorly lit communities along the way in Nigeria's oil-rich Niger Delta. This inspired them to develop a clean, cost-effective and sustainable energy solution for these communities. On campus, they researched possible ways they could solve the access to energy problems they had observed in the communities. With guidance from faculty member Mrs. Gloria Chukwudebe, a Professor of Electronics and Computer Engineering, GVE studied off-grid power solutions across the globe and how they could be replicated in Nigeria. The conclusion of GVE's research was that solar electricity was the most viable option for solving rural electrification challenges because of the availability of sunlight and the low cost of maintenance of the infrastructure. Backed by market research, GVE discovered that the rural dwellers were willing to pay for electricity – and more notably, GVE's proposition could cut energy expenditure in rural communities by 70%.

Later that year, the team participated in the Institute of Electrical Electronics Engineering (IEEE) "Change the World Challenge" and emerged top 5 from more than 200 applicants from across the globe. Two years later, they won a USD 44, 521 seed grant from IEEE foundation which served as early-stage funding.

GVE's pilot project, a 6kW solar mini-grid in Egbeke, Rivers State, was launched in 2013. GVE has since expanded to 12 locations across the country. The company has partnered with local and international organizations like the Bank of Industry (BOI), Institute of Electrical Electronics Engineering (IEEE) and The United States Africa Development Foundation to develop these 12 locations.

GVE raised its first funding from angel investments, as well as family and friends; however, now it has since received grants and concessional debts from donors and DFIs. The company also just completed an investment round with impact investors - All On and ElectriFi to raise capital for future expansion. The company plans to install 20MW of solar power to supply electricity to over 500 communities by 2022.



Operating model

GVE project implementations are preceded by extensive community engagements which build a sense of ownership among the residents. They select installation sites on the basis of availability of sunlight, least cost of deployment and maintenance.

Revenue collection in remote villages could be quite difficult due to the low banking penetration - locals of some of these communities travel long distances to use banking facilities. To ease payment for customers, GVE sells power to communities through local vendors who purchase electricity in bulk from GVE to sell to customers. The vendors act as GVE agents and facilitate access to payment in remote areas. Customers are sent a 20 digit recharge code via Short Message Service (SMS) when they make payments to the vendors.

Residential customers are required to pay a one-time connection fee of NGN 6000 (USD20). This fee covers installation of a prepaid meter and load limiter to track consumption and ensure efficiency by preventing the use of high energy consuming appliances.

GVE strives to keep their project operating costs as low as possible and thus their solutions are affordable for rural dwellers. Households powered by GVE mini-grids spend an average of USD 8 (c. NGN 2,500) monthly to enjoy 24/7 electricity.

A discounted tariff for small to medium enterprises (SME) forms part of GVE's strategic objective of stimulating the growth of rural businesses, improving productivity and boosting profitability.

Pilot Project: Egbeke, Rivers State

Egbeke is a community located two hour's drive from Port Harcourt, the Rivers State capital and is inhabited by the Etche ethnic group who are predominantly cassava and yam farmers. In 2013, Egbeke was part of the 50% of the Nigerian population that were not connected to the national grid. Petrol generators were used by the few who could afford them to generate power for household and commercial purposes.

In September 2013, GVE completed the installation of a 6kW solar power plant which powered 86 households. Two additional 9kW solar plants were installed in March 2015. Together, the three plants power 326 households and businesses in the community. Residents of neighboring communities come into Egbeke on a daily basis to take advantage of the community's power supply, as electricity is largely unavailable to them otherwise. This has been a major contributing factor to an increase in commerce in the region, as a number of businesses including hair salons, refreshment stores and phone charging stations have opened up to cater to this growing customer base. The Egbeke plant currently produces 8-12 hours of electricity daily.

Locals were involved in the project from inception and received plant maintenance training as a result. In addition, a number of trained personnel were selected to support the maintenance of the equipment post-installation.

As the pilot project, the Egbeke plant served as a test site for GVE and lessons learned have been implemented in subsequent PV solar plant installations at other sites. The GVE team now deploys new sites more efficiently; the first Egbeke plant was completed in 18 months while other plants subsequently installed by GVE were completed in an average of 6 weeks. Customers in Etche paid a connection fee of NGN 9,000 (c. USD 56), compared to customers in subsequent communities served by GVE who paid NGN 6,000 (c. USD 20).

Date Completed	Power Capacity	Funding Received	Source of Funds
September 2013	6 kW Plant	$44,521	Institute of Electrical Electronics Engineers
		+$20,000	Bank Of Industry (BOI)
		$100,000	United States African Development Foundation (USADF)

Most Recent Project: Bisanti, Niger State

Bisanti is a community of subsistence farmers in Katcha Local Government Area of Niger State located two hours from Minna, the state's capital. Prior to October 2015, Bisanti dwellers relied on petrol-powered generators, kerosene, candles, lamps and firewood as their main sources of energy. In October 2015, GVE installed a 37.8kW solar plant in Bisanti to supply 24/7 electricity to 280 households and businesses.

Bisanti village has transformed into a mini business hub since the installation of the GVE solar power plant. The village milling center that was previously powered by a diesel generator is now being powered by the solar plant, and has recorded higher levels of productivity at a lower cost. Small and micro businesses like barbing salons, tailoring shops, refreshment stores, phone charging stations and television viewing centers have sprung up around the community as well. These businesses are patronized by both residents and locals from neighboring communities as far as an hour away. Bisanti has experienced increased migration as people from neighboring villages and cities have relocated to Bisanti to live and do business. An example is a bakery from Taraba State which recently set up a branch in Bisanti due to the thriving business environment enabled by access to electricity. The availability of power from GVE's plant has led to a transformation of life in the community and business owners have experienced a surge in their income and profitability.

Essential human resources like teachers previously avoided the community due to the lack of electricity and the relatively poor quality of life. This has since changed as school teachers now prefer to stay in Bisanti, leading to improved literacy levels in the community with some running evening lessons for the students when necessary. This has had a tremendous positive impact on the pass rate of school students who are now able to study late into the night in preparation for exams. Similarly, healthcare has also received a boost as vaccines used in the community health center are now stored in refrigerators making them last longer.

Success Factors

Community Engagement:
GVE projects are preceded by extensive community engagement to ensure full buy-in from all stakeholders, educate them on the benefits of the solution, and to build a strong sense of ownership among locals. The company also hires maintenance officers locally, thus ensuring community involvement in the day-to-day running of the projects.

OEM Partnership:
GVE is a certified partner of some of the leading manufacturers of solar products in the world. This allows GVE to source its installation materials at low prices which significantly reduces capital expenditure on projects. GVE transfers this cost saving in capex to its end users which reduces the initial subscription cost. The partnerships also allow GVE to secure extended warranties on solar components and free replacement of damaged items within the warranty period. GVE engineers are also trained by the Original Equipment Manufacturers (OEMs) to perform after-sales services, allows GVE to make significant savings in operating expense as it spends less on replacing damaged items.

Tax Breaks:
The Federal Government of Nigeria has a pioneer status incentive for companies operating in pioneer industries or providing pioneer products. Such companies enjoy a three-year tax holiday which is extendable up to five years. As a renewable energy provider, GVE benefits from a five-year tax holiday owing to its pioneer status.

Corporate Governance:
From inception, the GVE team instituted good corporate governance structures aimed at increasing corporate accountability and mitigating the risk of corporate failure. This has enabled GVE to attract needed funding and partnership from local and international organizations.

Learning and improvement culture:
GVE has a strong learning and improvement culture. Deliberate efforts are made to transfer lessons from past projects to future ones. For example, while the first Egbeke plant was completed in 72 weeks, other plants subsequently installed by GVE were completed in an average of 4-6 weeks.

Early Stage Patient Capital:
Low-cost long-term funding from development organizations and donor agencies enabled the company to make a reasonable profit within its formative years.

Green Village Electricity (GVE): Solar Power for Off-Grid Communities

Established: 2012. Total Installed Capacity: 500KW

Tariff
Households pay an average of NGN 2500 ($8) monthly for 24/7 electricity.

Business Model
A one-time connection fee of NGN 600 ($2) for installation of a pre-paid meter and load limiter

Locations
Anambra, Rivers, Niger, Gombe, Plateau and Akwa Ibom States

Expansion & Growth Plans
Installation of 20MW solar power to supply electricity to over 500 communities by 2022

Impact
5,200 households in nine rural communities across six states

Key Investors

Customer Profile
Residential and small businesses

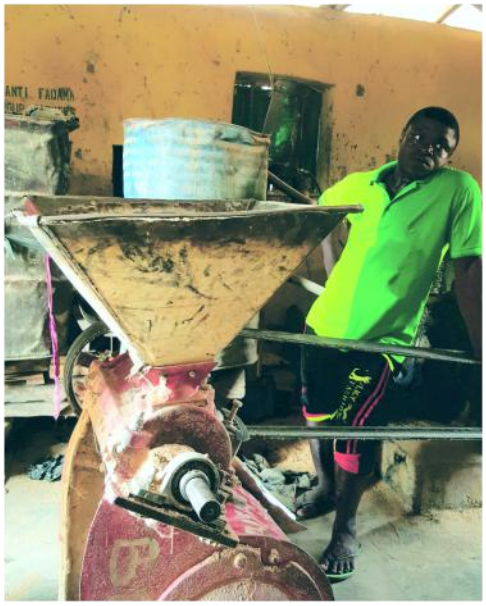
Customer Testimonials

"Prior to 2015, I powered my corner store via a 1Kv petrol generator which I ran for a few hours each day. Since I subscribed to the GVE solar plant in 2015, my monthly average energy spend has reduced by 70%. My revenues have also increased by over 150% due to the influx of customers from nearby communities (seeking cold beverages etc), new migrants, and the improving incomes of local business."

Ramatu Idris,
Small Scale Entrepreneur, Bisanti, Niger State

"Having electricity has brought my family closer… My family and I now spend quality time together in the evenings. My children are also able to study in the evenings because there is light"

Abdulahi Hassan,
Youth Leader and GVE Community Liaison, Bisanti, Niger State.



5B

Nigeria Electricity Supply Company (NESCO): Hydropower for Rural Electrification

History

Plateau became famous at the beginning of the 20th century for tin mining activities. In 1923, West Africa's first hydropower plant was constructed in Kwall village by a tin mining company and was acquired by the Nigeria Electricity Supply Corporation (NESCO) in 1929. NESCO was granted a 40-year concession by the Northern regional government to construct dams and power stations on the waterways in the Barkin-Ladi area. Following the 1962 decline of the tin mining industry and subsequent loss of its key customers, NESCO shifted focus to serving the communities and towns that surrounded the mines.

Operating model

NESCO runs a monthly postpaid billing system. Postpaid meters are installed for all customers and are monitored by NESCO to ensure accurate billing. New customers pay the following onetime connection fees

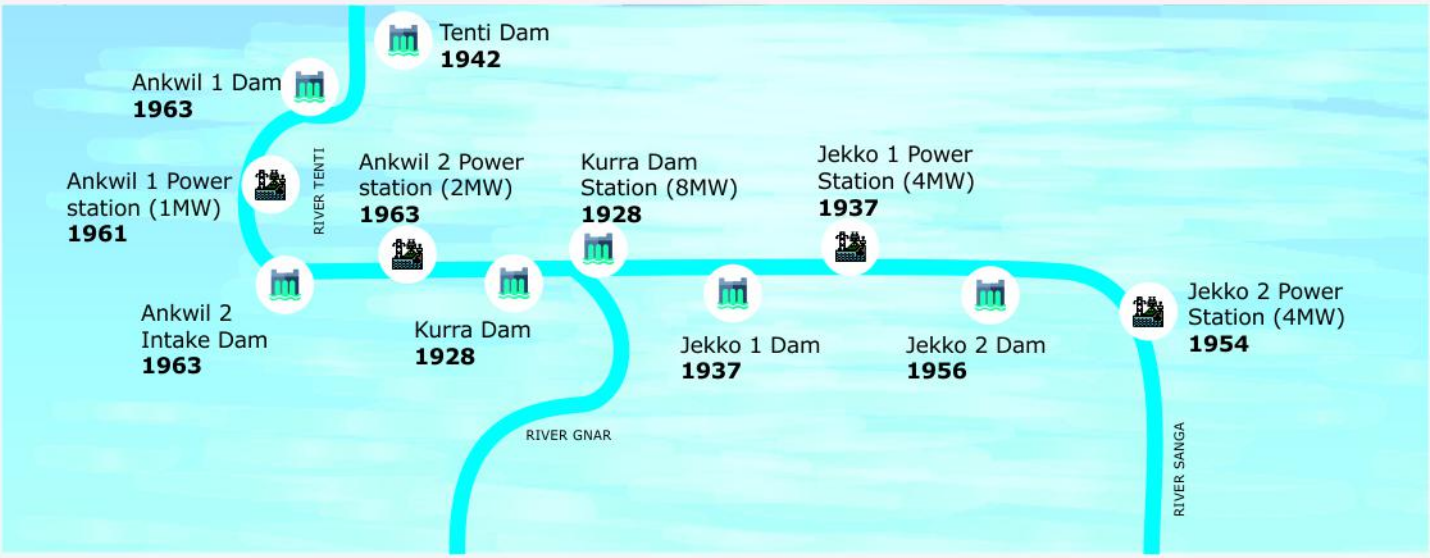
- Connection charge to subscribe to the NESCO network. The connection fee includes a postpaid meter, cables and other installation materials and depends on the capacity required and proximity to NESCO's distribution infrastructure,
- Capacity is charged at NGN 20,000 per kVA.

Customers in other areas without NESCO distribution pay for the connection infrastructure required to connect them in addition to the connection charge. Commercial customers also pay a similar connection charge depending on their capacity usage and other equipment like transformers that are deployed based on their consumption levels.

NESCO also supplies electricity to some communities through the Jos Electricity Distribution Company (JEDC). Customers in these communities are billed by JEDC which in turn pays NESCO.

Plants, Capacity and Impact

In 1929, NESCO completed the 3MW Kura Power Plant, at the confluence of River Gnar and River Tenti in Kura, Barkin Ladi Local Government, Plateau State. The power plant was upgraded to 8MW and served one of the biggest tin mining companies in Nigeria- the Amalgamated Tin Mines of Nigeria (ATMN) – a consolidation of smaller tin mines, as well as Dilimi Mines and Gold & Base Mines. As the tin mining businesses continued to grow and their energy requirements increased, NESCO constructed the Jekko1 4MW power plant along River Sanga in 1937 and in 1954, the Jekko2 4MW power plant was completed. Between 1961 and 1963, NESCO constructed the Ankwil 1 and 2 power stations on River Tenti.



NESCO's Barkin Ladi Power Station Network

The Reinvention

In 1960 tin mining waned in the region and ATMN stopped operations. With the loss of ATMN and closure of other major tin mines in Plateau, NESCO had to reinvent itself to attract new customers. They began to supply power to other communities beyond the mining areas and most of the other towns that grew out of the mining area to become urban settlements. As of 1970, NESCO had electrified 27 towns in the Benue Plateau region and they continued to be the sole electricity supplier to Jos. The odds seemed stacked against NESCO in 1978 when the Nigerian Electric Power Authority (NEPA) took over electricity supply in the city. However, NESCO was granted permission due to its reputation for reliability and superior service to provide bulk supply to designated customers and 10MW of public supply to NEPA. Examples of NESCO's capability include the provision of electricity to Jos, Bauchi, Yola and Gombe cities for six months when NEPA's 132KV line that supplied electricity to these cities collapsed and the building of transmission and distribution systems for NEPA to power towns as far as Keffi (over 200km away from Jos).

Emergence as a Utility Company

Following the liberalization of the power sector starting in 1998, the Federal Ministry of Power and Steel granted NESCO a 25-year complete electricity utility license to generate, transmit and distribute electricity to augment electricity supply in rural areas of Plateau and neighboring states effective from August 9, 2000. The license permits NESCO to provide direct electricity supply where public grid supply is not available and to provide standby services to customers.

NESCO currently serves over 6,600 customers in seven local governments in Plateau State. 85% of these customers are households while 15% are industrial and commercial users of various scale across the manufacturing, food and beverages, financial, agriculture, hospitality and educational sectors. Nearly every industrial electricity customer in Plateau State is served by NESCO. For most Plateau residents and businesses, NESCO is the electricity provider of choice having consistently provided round-the-clock electricity to communities and businesses in the area for almost 90 years.

Major commercial users served by NESCO includes NASCO Foods Ltd, Nigerian Bottling Company, Grand Cereals, Police College, Nigerian Institute of Policy and Strategic Studies and Integrated Diaries.

Success Factors

Prudent Management:
Since inception, NESCO has run entirely debt-free. All its projects and operations are funded by equity and retained earnings. As a policy, they retain 65-70% of their annual earnings to reinvest in the business. Their revenue comes from tariffs, the sale of bulk electricity and installation of power structures for state governments and distribution companies.

Made in Nigeria:
NESCO fabricates equipment spare parts locally from imported raw materials. This enables NESCO to have fast maintenance and repair turnaround times. It also enables them to make significant cost savings as they do not have to spend hard currency on the importation of spare parts.

Culture of Maintenance:
A key ingredient of NESCO's success is its strong engineering capability. It has well-equipped workshops manned by well-trained engineers who are able to install and maintain all their equipment. A case in point, NESCO runs double circuit transmission lines for redundancy and avoidance of single point of failure. NESCO has a very strong culture of maintenance hence many of the power generation, transmission and distribution equipment installed decades ago still operate efficiently.

Integrated Water Management System:
As water availability varies throughout the year, to meet a 'year-round water' availability goal, NESCO runs an integrated water management system with interconnected dams feeding their power stations. In addition to having large water reservoirs, NESCO recycles the water used to generate power at every power station through natural and artificial channels.

People-Centered Culture:
Over the years, the NESCO management has consciously built a diverse, performance-driven and people-centered culture. This culture is reflected in the spectrum of employees who are from different tribes and religions. Employees have a strong sense of ownership and job satisfaction working for NESCO, its staff attrition is very low - with some employees working for the company for as long as 50 years. The management runs an open door policy, maintains close-knit relations with their staff and provides staff benefits such as staff quarters and residential camps for field workers in the power stations.

Community Relations:
NESCO has also built a long-standing relationship with host communities. They employ locals as site officers in the communities where their dams and power generation stations are located. NESCO also provides free electricity and camp houses for these communities. This built a sense of ownership in the host community dwellers and has helped to keep NESCO projects secure in times of socio-political tensions.

Government Relations:
NESCO has been able to build good relationships with successive governments in Plateau State while maintaining its political neutrality. This has enabled them to thrive in spite of regulatory uncertainty and changes in administration.

Nigerian Electricity Supply Company (NESCO) Hydro Power for Rural Electrification

Established: 1929. Total Installed Capacity: 26MW

Tariff
Capacity charge and connection fee for initial connection. Monthly post payment based on consumption level

Business Model
Post-paid metering system for residential users. Bulk sale to commercial users, industrial users and Jos Electricity Distribution Company (JEDC)

Locations
Plateau State

Expansion & Growth Plans
Installation of new turbines to increase generation capacity

Impact
6,600 customers across seven local government areas in Plateau State

Key Investors
NESCO Investments Ltd.
Nigerian Mining Corporation

PIPC

Customer Profile
Residential, commercial and industrial, and JEDC

Customer Testimonials

"**Miango Rest Home (MRH),** a guest House in Miango town, receives electricity supply directly from NESCO. MRH experiences a high occupancy rate due to its 24 hours electricity supply. Students from the neighboring School of Accountancy also patronize MRH when they need a serene environment and constant power supply for academic research. MRH saves an average of NGN 1,715,500 (c. USD 5,624) per annum using constant electricity supply from NESCO and saves the environment an estimated 270 tonnes in Co2 emissions annually [Source: PwC field research].

5C

Presco Plc: Biomass and Biogas Power for Industrial Consumption

History

The Presco story began in the 1970s, with a World Bank-backed program established to promote the development of oil palm cultivation in the former Bendel State (now Edo and Delta States). Subsequently, the state-owned Oil Palm Company Ltd (OPCL) was established at the 1150 hectare Obaretin Estate, Edo State. In 1985, ownership of the oil palm estate was transferred to President Industries Nigeria Limited, under the new name Presco Oil Mill and Plantation. Presco's performance caught the attention of an agro-industrial giant from Belgium, the Siat Group, who purchased an ownership stake in 1991. With the support of the Siat Group, Presco went public in February 2002 and spearheaded an aggressive expansion program under which plant capacity was boosted and several oil palm estates were acquired.

Erratic power supply prompted the company to seek alternative power solutions, resulting in the installation of a 600kVA biomass-powered steam turbine. As factory capacity increased, the 600 kVA steam turbine was upgraded and additional capacity added, bringing the capacity to 4MW of biomass generated power.

Presco has an ambitious drive for 100% clean energy utilization by 2020. This goal was temporarily accomplished in the first two months of 2018, during which Presco's Obaretin facility ran entirely on renewable energy. Biomass currently provides 70-80% of the company's energy consumption while diesel generators provide 20-30%.

Operating model

Presco could potentially generate an aggregate 8MW of electricity from both biomass and biogas. Their biomass plant powers the oil mill complex and the staff quarters, while the biogas facility generates heat for the oil refining process.

At the onset of the company's operations, Presco's energy needs were supplied by the national grid. Intermittent power supply from the grid prompted the company to seek alternative power solutions, resulting in the installation of a 600kVA biomass-powered steam turbine. This marked Presco's first venture into renewable energy production. Presco's green energy initiatives have since flourished, and in 2016, renewable energy production saved the Obaretin plant 1,064,000 liters of diesel consumption and USD 861,185 (SIAT Sustainability Report 2016).

As factory demand increased, the 600kVA steam turbine was subsequently upgraded to 1MW and then to 1.2MW in 2011. Around the same time, the Siat Group began to consider the impact of its operations on the environment. Consequently, they joined the Roundtable on Sustainable Palm Oil (RSPO) as one of its first signatories. To comply with principle 5.4 of the RSPO, which mandates optimization in the use of renewable energy, Presco commissioned a separate line for a 2.5MW steam turbine in 2014. A 1.5MW biomass-powered turbine was also installed as a replacement of the existing 1.2MW turbine which was moved to another company within the SIAT group.

Plants, Capacity and Impact
The Biomass Plant

Presco's biomass power generation process is integrated into the palm oil producing process. The process begins with the sterilization of fresh palm fruit bunches. Fresh fruit bunches are funneled through a series of sterilizing units and then conveyed to threshers where they are deseeded. These hollow bunches are passed through a series of shredders to increase surface burning area. The shredded masses are burnt to generate steam for turning two turbines of 1.5 and 2.5MW capacity. About half of the steam fed into the 2.5MW turbine is re-captured and condensed into water and reused to produce steam for generating power.

The turbines jointly power the entire oil mill complex and Presco's staff housing estate. Electricity is transmitted to the staff housing estate through self-installed overhead power lines to provide 24 hours electricity to the estate.

The Biogas Plant

Palm oil milling yields Palm Oil Milk Effluent (POME). Palm oil millers have to find environmentally friendly ways of disposing this highly toxic by-product in line with the RSPO's best practices in efficient waste management. Presco conceptualized an Effluent Management System (EMS) to generate energy from POME through a bio-digester. The system was commissioned in 2014 as West Africa's first biomethanation plant.

The EMS is a highly efficient dual-purpose system. It detoxifies POME by extracting biogas from it. The biogas is used instead of diesel for heat generation in the refinery and can also be used to generate power. The detoxified POME is then used as fertilizer for Presco's plantation.

The effluent management system produces twice as much biogas needed for the heat generation system. If the biogas produced is fully used for power generation, it can generate up to 4MW of electricity. Presco plans to use the excess biogas to produce 2MW of power in the future. Presco recovered its investment in the biogas plant in three years despite it functioning at only 50% capacity.

With a total power generation potential of 8MW from its biomass and biogas plants, Presco Plc can sufficiently meet its internal energy demand and would still have additional capacity to provide power to external customers.

The Biogas Production Process

Step 1
Lagoon bio-digesters detoxify Palm Oil Milk Effluent, the waste water generated from the palm oil milling process.

Step 2
An anaerobic process decomposes the biodegradable material in the detoxified liquid into biogas.

Step 3
Hydrogen Sulfide (H2S) and water are expelled from the biogas in a filtration sytem.

Step 4
The biogas produced is pumped into the refinery to replace diesel in the refinery's heat generator.

The Biomass Production Process

Step 1
Fresh fruit bunches from the plantation are funnelled through sterilizing units.

Step 2
The purified bunches are conveyed to the threshers where the bunches are deseeded.

Step 3
The hollow bunches are passed through a series of shredders to increase surface burning area.

Step 4
The shredded bunches powers the boiler in the furnace, which generates steam.

Step 5
This steam is channelled to the turbines, and then spun through a dynamo to produce electricity.

Step 6
The electricity produced is transported to Presco's complexes.

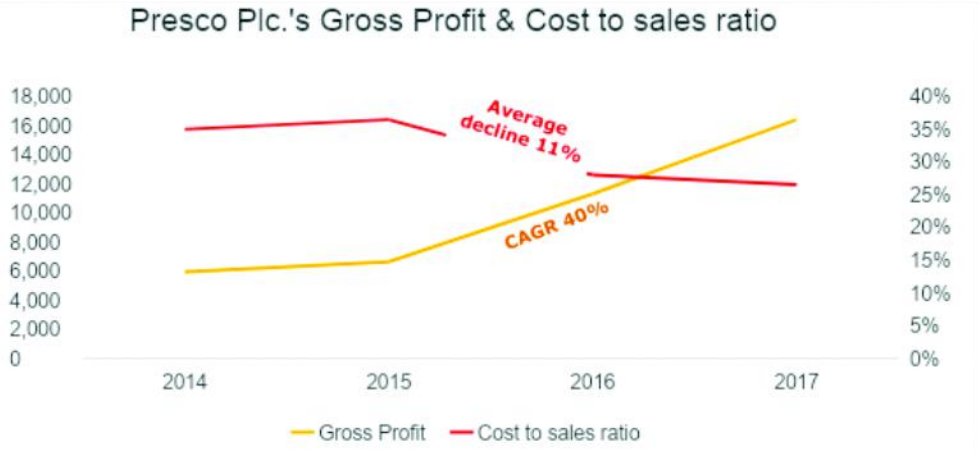
Success Factors

Ready Availability of Input Fuels: The primary success factor for these facilities is the availability of input fuels for both plants. The empty fruit bunches, byproducts of oil palm processing, serve the feedstock for the energy generation.

Commitment to Sustainable Best Practices: Presco's operating system ensures that often-discarded items are reused. For example, the recycling of detoxified Palm Oil Mill Effluent (POME) into fertilizer for the plantation. The water used in cooling and steam generation in both facilities is derived from repurposed waste. About half of the steam fed to the 2.5MW turbine is re-captured and condensed into usable water.

Impact on Company Financial Performance

Recycling has enabled Presco to minimize its cost of operations. The significant cost savings made by the switch from diesel generators to biomass has helped decrease overall operating costs and increased profit. Presco has experienced remarkable growth in profit while reducing its cost of production. Since the expansion of its renewable energy generation facilities in 2014, the firm's cost-sales ratio has decreased by an average of 11% while gross profit has grown at a compound annual growth rate of 40%.



Presco PLC: Biomass and Biogas for Industrial Consumption

Established: 2014. Total Installed Capacity: 4MW

Tariff
Self consumption

Business Model
Currently, power generated is for self-consumption

Locations
Edo State

Expansion & Growth Plans
To supply excess power to national grid on other customers

Impact
Saved Presco 1,064,000 litres and $861,185 in 2016

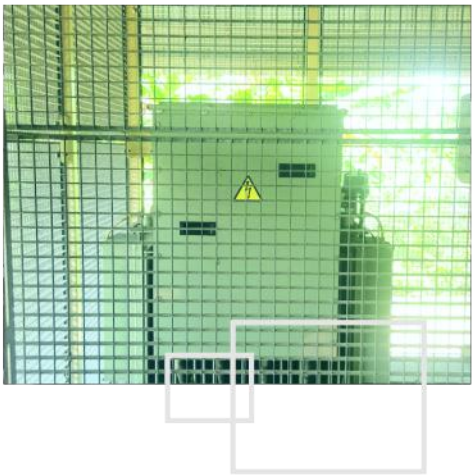
Key Investors

Customer Profile
Residential, agricultural and industrial


DANGER
NO SMOKING
NO OPEN FLAMES
NO SPARKS

5D

Bonny Utility Company: Gas for Community Power



History

Once renowned for oil palm trading, Bonny Kingdom now hosts three of Nigeria's largest oil and gas corporations. In an effort to give back to their host community, the oil and gas corporations on Bonny Island committed to supplying the community with uninterrupted power and water. In 1998, three oil and gas giants: Nigeria Liquefied Natural Gas (NLNG), Shell Petroleum Development Company (SPDC) and Mobil (now ExxonMobil) signed a memorandum of understanding to meet this goal as the Joint Industry Companies (JIC).

The JIC member firms set out to upgrade the existing electricity supply and distribution systems in the Bonny Kingdom and the Bonny Utility Management Committee (BUMC), was established in 2001 to oversee these operations. The committee, comprised of mostly Bonny indigenes, was however incapable of independently executing the mandate, as they lacked the required technical capacity. The BUMC and the JIC subsequently formed the Bonny Utility Company (BUC) to address this issue, with the JIC providing technical expertise. The BUC was incorporated in 2007, with NLNG as the majority stakeholder with 60% ownership, and SPDC with 40% ownership. Though not a shareholder in the company, JIC-member firm, Mobil committed to cover 20% of annual costs.

Stakeholders

Ministry of Power

Ministry of Water

Local Government Agencies

Bonny Kingdom

Nigeria LNG Limited

ExxonMobil

Joint Industry Companies (JIC)

Provide Support: Right of way, office premises, technical expertise, licenses to operate

Funding, power, technical, administrative, and managerial expertise

Bonny Utility Company

Service Provider

Electricity and water, street lighting, employment and contracts

Electricity payment

Community: Residential users, small businesses, worship centers, e.t.c.

Customers

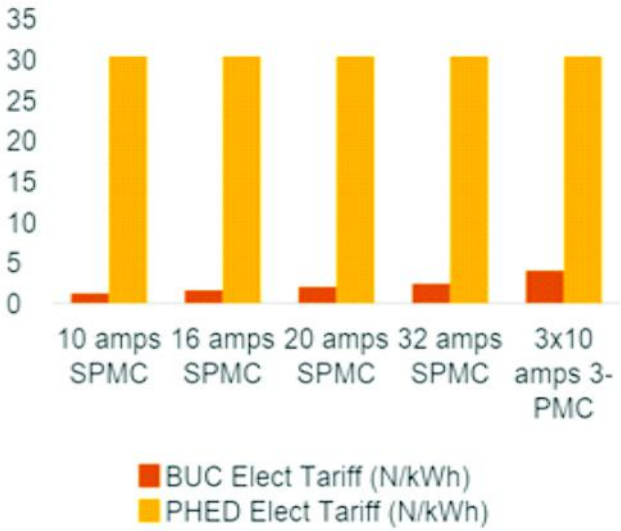
Today's Bonny Kingdom contrasts sharply with the quiet agro-town it used it to be. Crystal clear potable faucet water and uninterrupted power supply have replaced ochre-tinted water and kerosene lamps. This advancement can be directly attributed to the BUC's effectiveness in delivering on its mission to provide safe and reliable electricity and potable water to the Bonny Kingdom. In the sixteen years since BUC's launch, power availability on Bonny Island has never fallen below 90% and Bonny indigenes have enjoyed an improved quality of life and business environment.

Operating model

BUC was incorporated as an independent non-profit organization. Stakeholders include the JICs, Bonny Kingdom, local government agencies, and the Ministry of Power. JIC-member firms Nigeria Liquefied Natural Gas (NLNG) and Shell Petroleum Development Company (SPDC) donate gas-powered electricity to the BUC, which is then distributed into the community. The JIC companies and the Rivers State Ministry of Power supply manpower via seconded staff.

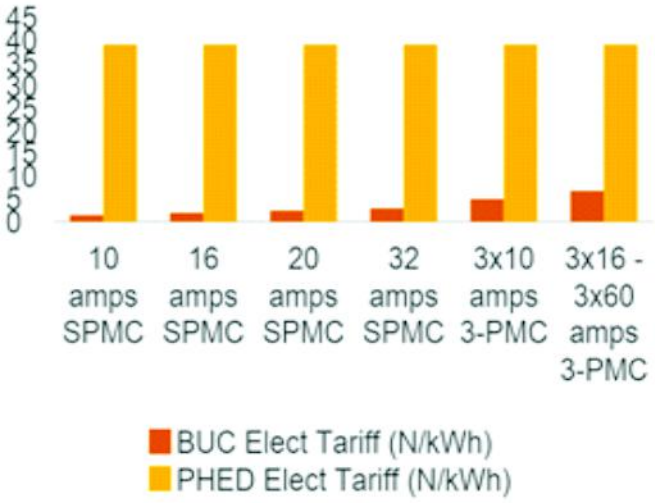
Under the Basic Electricity Allowance Program (BESA) program, BUC provides the Bonny Island community with a fixed amount of free power. This allowance sufficiently meets the power consumption needs of over 40% of customers. Other customers can purchase additional power from the BUC at an affordable rate. On average, the BUC charges less than 20% of the Port Harcourt Distribution Company's (PHDC) tariffs. Even though the cost of paid for power is subsidized, the fact that customers do not get an unlimited amount of free power drives a culture of energy efficiency.

Residential Tarriffs (BUC vs PHED)



Service Class	BESA Provision
10 amps SPMC	283 kWh
16 amps SPMC	213 kWh
20 amps SPMC	170 kWh
32 amps SPMC	142 kWh
3x10 amps 3-PMC	85 kWh
3x16 amps 3-PMC	58.6 kWh

Commercial Tarriffs (BUC vs PHED)



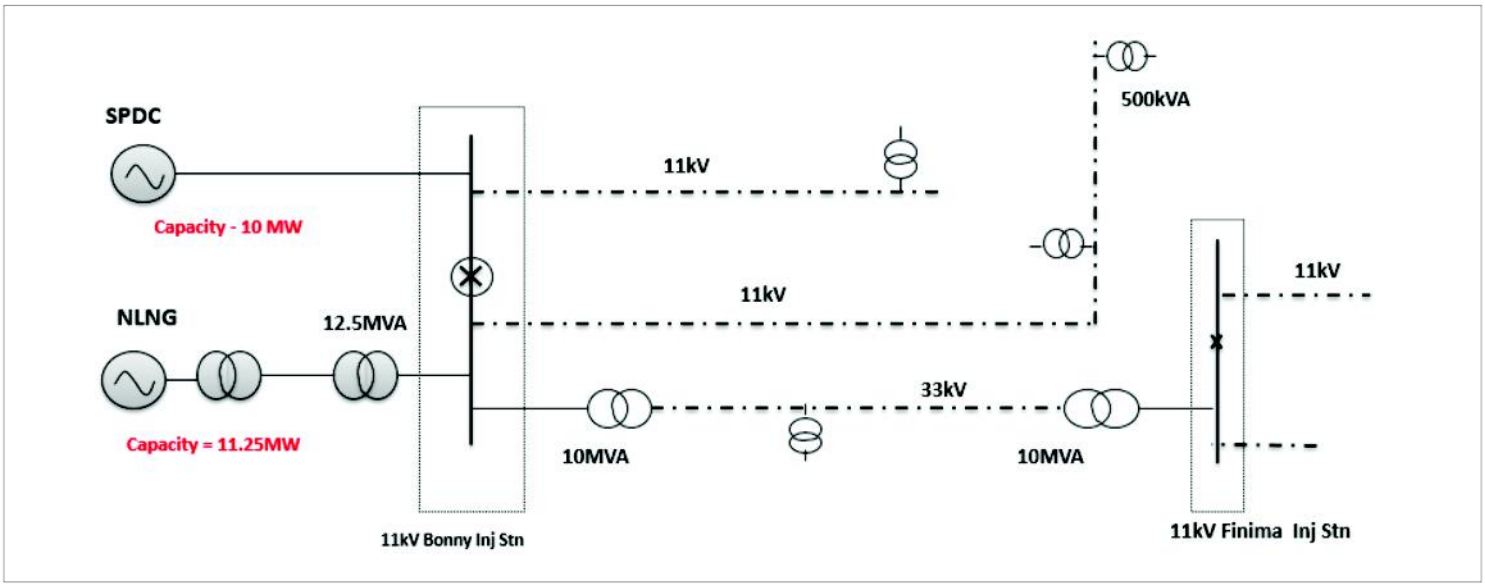
Service Class	BESA Provision
10 amps SPMC	58.6 kWh
16 amps SPMC	58.6 kWh
20 amps SPMC	58.6 kWh
32 amps SPMC	58.6 kWh
3x10 amps 3-PMC	58.6 kWh
3x16 - 3x60 amps 3-PMC	58.6 kWh

While the PHED charges flat rates for residential and commercial customers, regardless of their individual power capacity, the BUC employs a multi-leveled tariff structure tailored to varying power usage rates.

Plants, Capacity and Impact

BUC's power distribution process begins with the transmission of JIC-supplied electricity to the 11KV Bonny injection station. SPDC supplies 10MW, while NLNG supplies 11.25MW power. The combined 21.25 MW power is then transmitted to the community via three feeder cables. Two of these feeders (11KV) are networked directly from the injection station to the Bonny community. The last feeder cable (33KV) is networked to the Finima injection station where the electricity is stepped down to 11kv and distributed into Finima town.

The BUC power network consists of 54 distribution transformer substations, 3 step-down transformers, and over 140 kilometers of power distribution lines. The distribution power lines consist of 35 km of 11KV overhead distribution lines, 8km of 33KV overhead distribution lines, and over 100 km of low voltage distribution lines. About 14,000 customers are connected to BUC's distribution grid via prepaid meters. BUC's power availability rate is currently 98.9%, exceeding its initial target of 96%. Current peak load demand is 17.6MW, with a current maximum capacity of 22.5MVA. Monthly power consumption averaged 8782 MWH/month in 2017.



There was initially some controversy around the payment for electricity. However, once people began seeing the results, the skepticism quickly changed to enthusiasm and eagerness to get connected. Today, the members of the community understand the need to attach value to power services and understand the need for fee-paying as the only sustainable mechanism that guarantees the future of the services and curbs the waste that results from "free" arrangements.

The impact on the community has been very positive. Businesses are flourishing because machines and computers can be utilized all day long and public services are maximized. A good example is the Bonny General Hospital, which has been able to double the number of operations it provides because it enjoys uninterrupted power.

Success Factors

Pre-payment Metering System:
BUC pioneered the pre-payment metering system in Nigeria, which has reduced the incidence of payment evasion. Customers pay into designated banks and use the bank teller to redeem a 20-digit token, which is loaded into the meter. The bank tellers and tokens are unique and valid for one customer. To curb power theft, BUC installed a sophisticated tracking system that monitors discrepancies between customer payment and power consumption. Backup meters monitor meter by-passes. In addition, the BUC conducts regular inspections as a third-level check. The pre-paid metering model has reduced energy wastage, consequently promoting power sustainability.

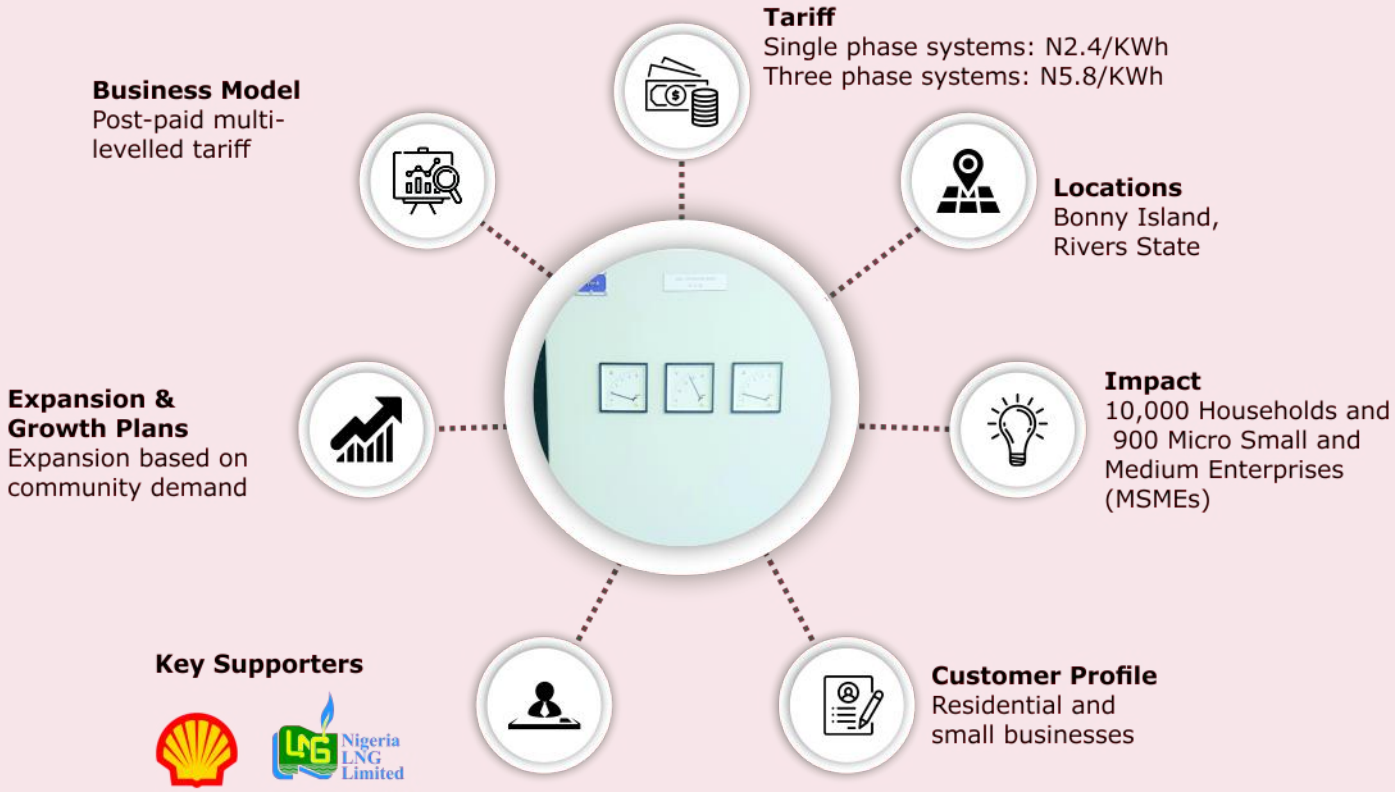
Community Engagement:
Developing local talent is one of the major objectives of BUC and today the Bonny Kingdom indigenes currently account for 95% of BUC's workforce. By developing local capacity, BUC has instilled company pride in its indigenes. Because the people of Bonny Kingdom take a sense of pride and ownership in the company, they actively work towards its best interest. Members of the Bonny Island community frequently serve as volunteer vigilantes who protect the power infrastructure against vandalism and report suspicions of power theft.

Corporate Partnership:
Support from BUC parent companies has been vital to the success of BUC's operations. The JICs supply electricity and top talent to BUC and also cover some of its operating costs.

Government Support:
Ministries and other government agencies play major roles as stakeholders in BUC's operations. They ensure that applicable tax exemptions and required operational licenses were provided, which have helped reduce BUC's tax bill and improved the ease of operations. The government also provide manpower in the form of seconded staff.

Bonny Utility Company: Gas for Community Power

Established: 2001. Total Installed Capacity: 21.5MW



Customer Testimonials

"My frozen fish business has been more profitable than it would have been in any other part of the country. Because of the low cost of electricity, I am able to go home with huge profits.

Owner of frozen fish business

"In the six years that I've been running my supermarket, I've been able to triple my inventory thanks to BUC. Because light is constant, my goods can be stored for a long period of time, which has allowed me to grow my business exponentially.

Supermarket manager

"My hotel business is booming. We've enjoyed a significant profit margin in my hotel business because of the low cost of electricity. We've successfully expanded from one hotel in Finima to two additional hotels in Bonny and the city of Port Harcourt.

Hotelier


refresh

5E

Alausa Power Plant (APP): Gas Power for Public Sector Customers

History

In 2009, the Lagos State Government embarked on a drive to have a stable and cost-effective power supply for the running of its secretariat and other facilities within the state capital. Prior to that, the state relied on diesel generators to power the state secretariat, staff quarters, government house and other government facilities in the Alausa area of Lagos due to the unstable power supply from the national grid.

Alausa Power Limited (APL) was established in 2013 as a Public-Private Partnership (PPP) between Lagos State Government and Oando Gas and Power Limited (now Axxela) to serve the government facilities.

As operations commenced, APL observed that the government's load profile was usually very high during the day –up to 80% of plant capacity –between 8 am and 4 pm while it was usually as low as 20% in the evenings. Apart from power wastage, this inefficiency posed a threat to the functionality of the plant as the engines have minimum required capacity utilization. To efficiently utilize the stranded capacity in the evenings, Lagos State decided to connect the power plant to government staff quarters and street lights in the state capital. The State also had to construct more street lights across the city to increase night-time consumption.

In its bid to diversify into the power sector, Elektron Corporation bought over APL from Axxela in December 2016 and took over its operations in 2017

Operating model

As a captive power project, APL does not rely on grid infrastructure for its operations. It was built with its own underground cable network and distribution infrastructure.

APL has a 10 year take-or-pay Power Purchase Agreement (PPA) to supply power to Lagos State government as their sole customer. The government, in turn, charges the staff quarters residents for their consumption through a prepaid metering system. The government pays APL a connection charge, which covers the cost of materials for connecting new facilities to the plant.

Success Factors

Ready Off-taker:
APL's take-or-pay agreement with the state government guarantees that the government will always take up and pay for the power generated. This guarantees consistent cash flow for APL to meet its operational and commercial obligations. The agreement also serves as a backstop for APL in securing loans from financial institutions.

Feedstock Availability:
APL was designed to leverage the existing gas pipeline in the Ikeja area for gas supply. The plant was built with a pipeline connecting it to the Ikeja 1B pipeline under the Greater Lagos pipeline network. APL has a minimum take-or-pay contract with Gaslink who owns the greater Lagos gas supply franchise. The agreement ensures that APL gets priority gas supply at commercial rates.

Cost-Reflective Pricing:
APL's agreement with the state government allows it to charge cost-reflective tariffs. Its tariff is reviewed periodically based on gas pricing and other economic realities

Government Support:
APL benefits from a pioneering status granted by the federal tax authorities. The state government also supports the business by providing offtake guarantees needed to access funding.

Alausa Power Limited (APL): Gas to Power for Public Sector Customers

Established: 2009. Total Installed Capacity: 10.4MW

Business Model
Lagos State government pays for total monthly power generation as sole off-taker. Staff quarter residents pay the state government for their consumption on pre-paid basis

Tariff
Confidential

Location
Ikeja, Lagos State

Expansion & Growth Plans
Increase capacity to 20MW and extend power supply to other commercial consumers within the Alausa area.

Impact
Serves >4,000 staff in 40 Government departments; 120 households, and over 70km of street lighting

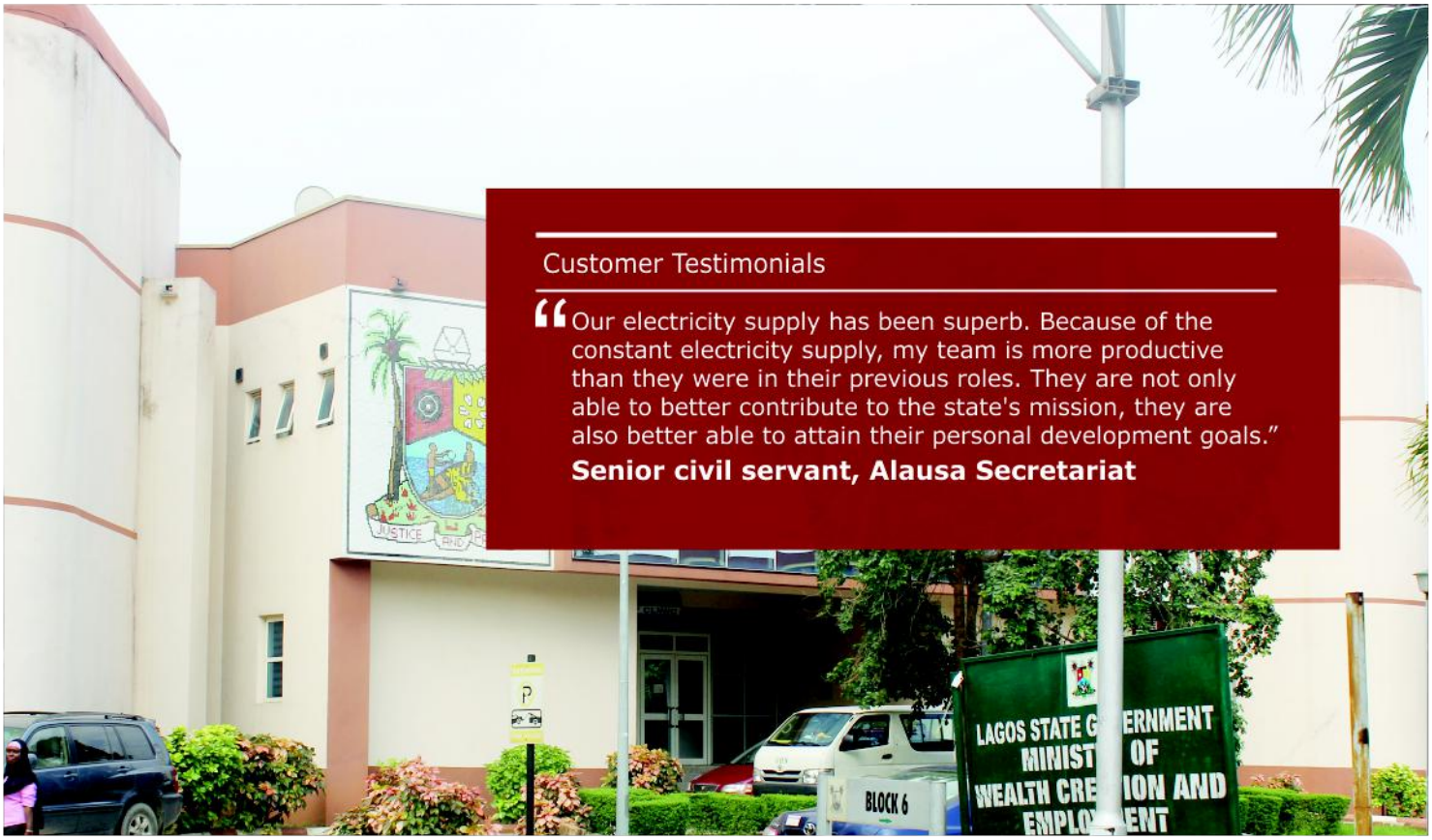
Key Investor
Elektron Petroleum Energy and Mining

Customer Profile
Government and public services

Customer Testimonials

"Our electricity supply has been superb. Because of the constant electricity supply, my team is more productive than they were in their previous roles. They are not only able to better contribute to the state's mission, they are also better able to attain their personal development goals."

Senior civil servant, Alausa Secretariat




Alausa Power
Elektron

5F

Lumos Nigeria: Retail Solar for Homes & Small Businesses

History

Lumos was established to provide sustainable and affordable electricity directly to off-grid consumers. Lumos was founded by two partners, one with experience in solar project development and the other with experience with emerging market mobile operators. The Lumos' pay-as-you-go home solar systems idea was borne out of two major trends: the explosion of mobile payments in Africa and the dramatic decrease in prices of solar technology. The Lumos founders believed that they could do to electricity access what mobile phones did to traditional landlines in Africa; which is to sell directly to customers, and use prepaid technology to make the service affordable. The resulting business has seen exponential growth: selling 3,700 systems in 2015 during a pilot phase, 22,000 more systems in 2016, and 48,000 more systems in 2017 after rolling out the service nationwide in Nigeria. As of mid-2018, Lumos has installed nearly 6MW of solar electricity in Nigeria.

In 2016, Lumos signed a partnership with MTN Nigeria to access MTN's mobile payment infrastructure and retail distribution network. Lumos also secured $50M in debt financing from the Overseas Private Investment Corporation (OPIC), the U.S. development bank. This amount was at the time the largest debt facility in the off-grid home solar industry.

Operating model

Lumos systems are supplied in MTN stores across the country. Customers sign up for the service by paying a one-time commitment fee, after which they purchase pre-paid electricity bundles.

Customers pay for electricity using their MTN airtime accounts just the way they currently purchase airtime or data for their phone.

The Lumos proprietary technology locks the system remotely, and only turns the system on after payment. After five years of electricity usage, customers gain ownership of the system, and Lumos unlocks the system so that customers can have free electricity.

Success Factors

High Capacity Systems:
Whereas most of the major solar off-grid home solar systems are 8- 20W, the Lumos system is 80W, giving enough power for lights, fans, TV and cell phone charging all at the same time. This attracts customers who prefer Lumos systems as it can be used to power more appliances than the conventional smaller solar home system.

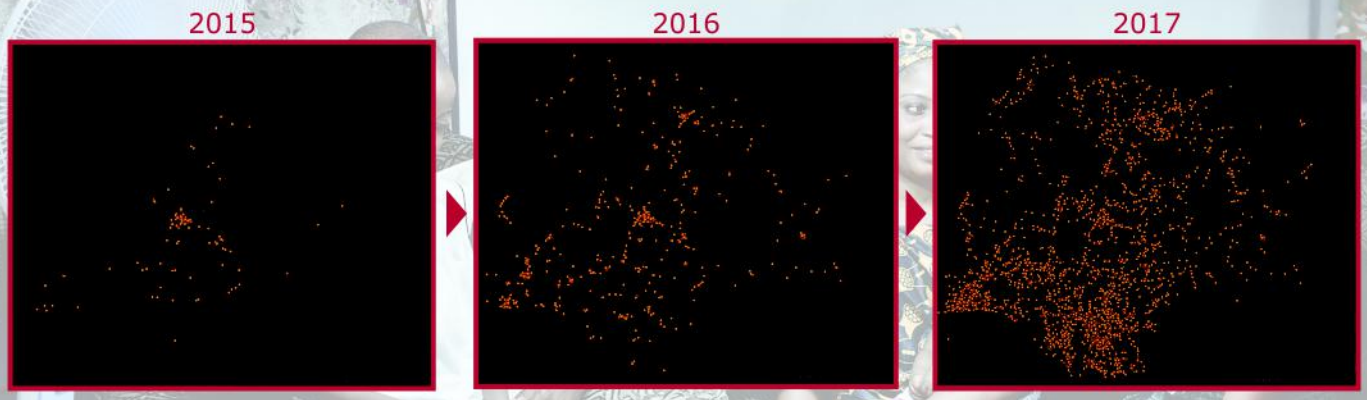
Strategic Partnership:
The Lumos partnership with MTN allows it to leverage MTN's nationwide retail footprint to sell its products to customers across Nigeria. MTN also offers Lumos its mobile payment infrastructure that is easy for customers to use and adopt.

After Sales Support:
Lumos provides a five-year guaranteed repair service to its customers.

Financing:
Access to long term finance is key to succeeding in deploying pay-as-you-go solar home systems.

Cutting Edge Technology:
Lumos' back-end technology controls each of the solar home systems remotely. It also receives hourly data on consumption and functionality of the system. Every system sends a statistical report on generation and consumption to the Lumos database at the end of each day. The Lumos customer center can also monitor the status of any system in real time. This helps provide timely after sales services to their customers.

Lumos Nigeria Installations Over Time



Lumos Nigeria: Retail Solar For Homes And Small Businesses

Established: 2015. Total Installed Capacity: 6MW

Tariff
Customers purchase pre-paid electricity bundles for an average of NGN 150 per day

Business Model
One-time commitment fee. Pre-paid electricity bundles through mobile recharge

Locations
Nigeria, Cote D'Ivoire

Expansion & Growth Plans
Grow service in Nigeria and expand to other African nations

Impact
75,000 customers across Nigeria. Saves energy costs in rural communities by 70%

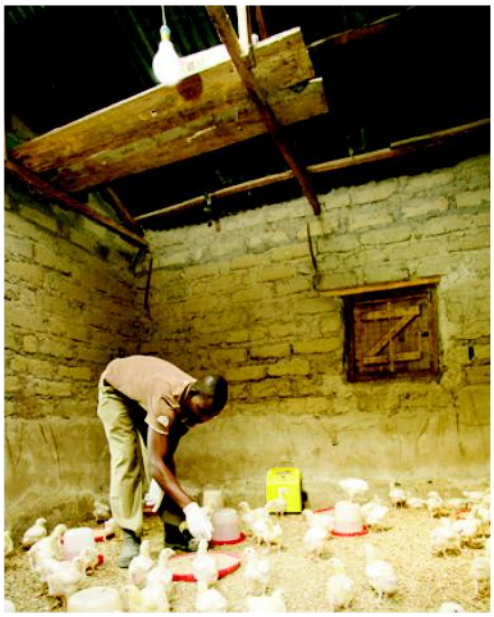
Key Investors
Allon VLTCM
PEMBANI • REMGRO
INFRASTRUCTURE MANAGERS
OPIC

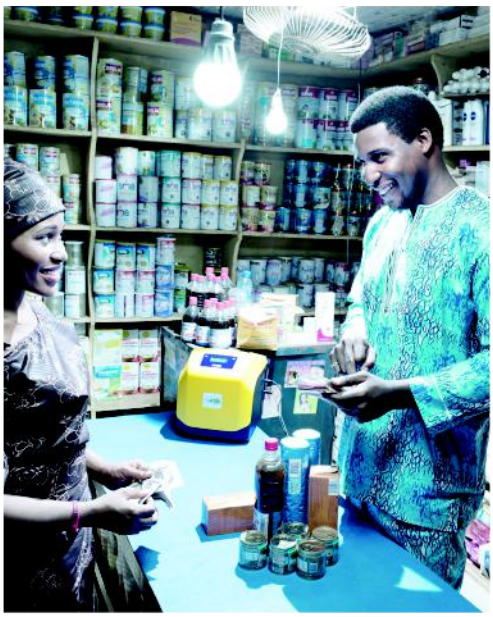
Customer Profile
Residential and small businesses

Customer Testimonials

"Our business here normally requires us to work late into the night sorting mails. We don't close until every single mail has been dispatched. In the past, we had to depend on petrol generators due to the unreliability of power supply from the grid. Since purchasing the Lumos system, we've completely stopped using the generator because there is simply no need for it anymore! The system is very reliable and there have been absolutely no issue with it. It is very convenient, provides very bright electricity and we use it until we close at night with no problems at all. Today, we can work as late as we want without worrying and we're saving a lot of cost by not spending money on expensive fuel anymore. It's very affordable, and my boss just got one for his house. Everyone is very happy with it."

Kabiru (Area 10 EMS Postal Service) Abuja, FCT.






ROOSEVELT
VIKING

5G

Energizing Economies Initiative (EEI): Off-Grid Power for Micro, Small, and Medium Enterprise (MSME) Clusters

History

The Energizing Economies Initiative (EEI) is an initiative of the Federal Government of Nigeria (FGN) launched in September 2017. The initiative targets Micro, Small, and Medium Enterprises (MSMEs) with the objective of supporting the rapid deployment of off-grid decentralized electricity solutions to provide affordable, clean and consistent power to economic clusters in Nigeria through private sector developers. The initiative is being implemented by the Rural Electrification Agency (REA), which is an agency under the Ministry of Power, Works and Housing.

The EEI is being implemented using a private sector-driven model where the projects are developed and funded by private sector developers. The REA is responsible for creating the enabling environment and carrying out all of the pre-development activities for successful project implementation.

The REA also facilitates all regulatory project activities and fast tracks the project roll-out by managing all interactions and correspondence with Ministries, Departments and Agencies (MDA) at the federal and state levels. The USAID Nigeria Power Sector Programme (NPSP) through Deloitte, McKinsey & Company and Cross-Boundary Energy provides REA with technical support for the initiative.

EEI has launched three projects in Phase 0 aimed at electrifying 50,000 shops within the following economic clusters: Sabon Gari Market (Kano State), Ariaria Market (Abia State), and Sura Market (Lagos State). EEI also has another 13 markets in Phase 1 at various stages of development and construction across the country.

EEI Projects

Sabon Gari Market Kano

Sabon Gari Market Kano, Kano State, built in 1914, is a one-stop, all-inclusive market for commodities located in the heart of Kano city in Kano State with 13,000 shops. Sabon Gari Energy Solutions Limited (SGESL) is the developer of the project. The energy audit carried out by REA indicated that most shops were powered by alternative sources of power, with 98% relying on some form of generator for their power supply.

In February 2018, SGESL installed high capacity solar lithium based standalone systems to provide stable power to the market. As of October 2018, SGESL is providing sustainable power to 1,198 shops with plans to expand the customer base to cover all 13,000 stalls in the market.

Ariaria Market

Ariaria Market, Aba, Abia State has 50,000 shops with a 95% utilization rate. The provision of electricity for trading operations has been primarily through privately owned generators installed for each of the market's 90 zones.

The developer on this project is Ariaria Market Energy Solutions Limited (AMESL), an SPV consisting of three companies: Total Support (power generation services), Talevares (power distribution services), and Candesco Limited (metering services).

Sura Shopping Complex

Sura Shopping Complex, Lagos Island, Lagos State is a market with 1,047 shops located only 2 kilometers away from an existing independent power plant (IPP). As a result, the electricity solution is to take the excess capacity from the gas powered Lagos Island IPP to power the shopping complex through a dedicated underground distribution network.

The developer for Sura shopping complex is Sura Independent Power Limited (SIPL). SIPL covers the cost of design, distribution network infrastructure to connect the IPP to the complex, distribution equipment (control panels upgrades within the complex, metering of every shop and provision of alternative power as a backup to the IPP.

Operating Model

SGESL produces and sells solar power directly to the traders under a collaboration agreement with the market association and state government.

AMESL has an agreement with the Ariaria International Market Association and end users to guarantee exclusivity and off-take payments for power supply and distribution to the market.

AMESL provides electricity to the market using gas-fired engines, with customers connected via an extensive distribution and metering network.

SIPL has signed agreements with IPL to off-take power and has subsequent agreements with the Sura market association and its end users to supply power.

All three companies have customer care centers located within the markets which serve as customer registration, payment, and complaint resolution points. Customers pay a one-time connection fee and daily/weekly charge depending on appliances utilized.

In all three markets, every shop has a meter installed and customers only pay for the power they utilize.

Success Factors

Government Support:
REA serving as a 'one stop shop' in government to support with negotiations, fast-tracking of agreements, issuance of licenses, and engagement with the market associations and end-users ensured all stakeholders of the project's viability

Data-driven Solutions:
Holistic baseline surveys and energy audit data collected by REA were provided to the developers to design customer-focused solutions. The comprehensive data also facilitated the development of concise financial models and earnings projections which aided with securing financing.

Community Engagement:
The projects were preceded by extensive community engagement by the REA to ensure stakeholder buy-in and education on the benefits of the solution. The developers continue to focus on engaging with local stakeholders to build a sense of community ownership as well as trust between the developer and customers.

Ready Off-Takers:
The agreements between the developers, the end-users and market associations guarantee exclusivity of power supply and off-take to the markets. This guarantees consistent cash flow for the developers to meet operational and commercial obligations while also ensuring affordable and reliable power for the customers

Energizing Economies Initiative : Off-Grid Power for Micro, Small and Medium Enterprise (MSME) Clusters

Established: 2017. Total Installed Capacity: 10MW

Tariff
Customers are metered and pay a one time connection fee and daily/ weekly charge based on consumption levels.

Business Model
Generate clean energy from small IPPs and distribute to individual stalls in the markets using smart meters

Locations
Sabon Gari Market Kano State, Ariaria Market, Abia State, Sura Shopping Complex, Lagos State

Expansion & Growth Plans
Expand capacity in three current locations and add at least 12 new markets over the next year

Impact
Will serve up to 70,000 MSMEs across the three pilot locations.

Key Investors

SOLAD

rensource

Customer Profile
Micro, Small and Medium Scale Enterprises (MSMEs)

Customer Testimonials

"Customers coming into the shop now feel more comfortable, we can entertain them with music and fans because there is light for all and the noise from the generators, I don't get to hear the noise anymore.

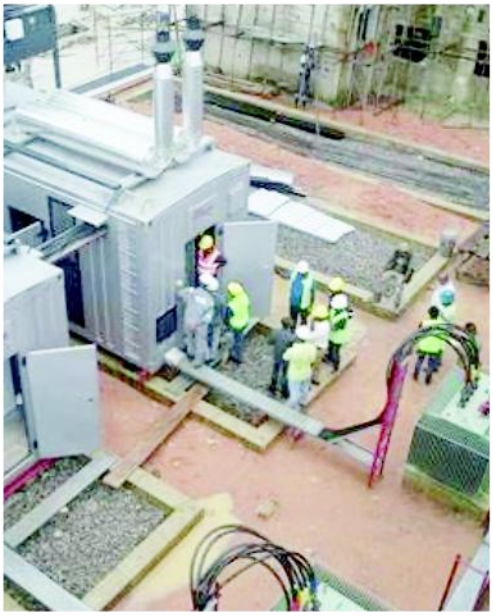
Ms. Chinagorom – Clothes Trader (Ariaria Market, Abia State)

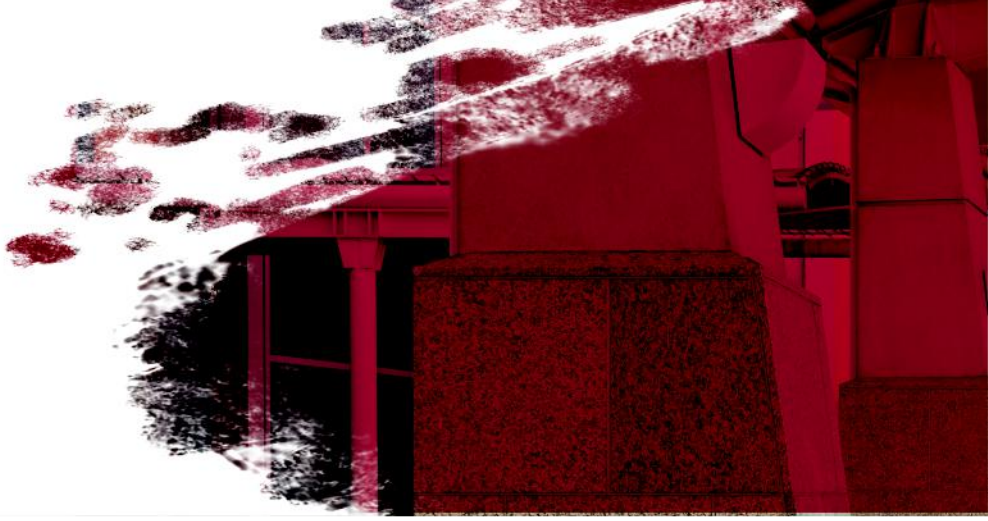
"It helps us a lot in saving money, instead of spending N1000 a day on generator, you spend only N150 to N200 daily on the solar

Mr. Ahmed - Shoe Trader (Sabon Gari Market, Kano State)

"One of the major issues that made the occupancy ratio in Sura to be less than 50% was because of electricity, since the IPP this has significantly increased and shop owners that were using their shops for storage are now converting them back to shops.

Mrs. Ajayi - Association of Shop Owners (Sura Market, Lagos State)





What Next?

Off-grid clean energy is expected to contribute 8,000MW to the energy mix in Nigeria by 2030. In order to unlock the potential of the off-grid subsector and achieve this target, some key growth enablers have to be in place. Some of the future growth enablers include:

Investment Shift:
Most of the off-grid energy businesses in Nigeria have been financed by seed funds from International Development Agencies (IDAs) and Development Finance Institutions (DFIs) and in some cases Venture Capital funds. These businesses will require adequate capital finance to enable them to scale up. Commercial banks, private equity firms, and other capital finance institutions need to invest in the sector to drive growth. Industry players also need to be willing to open their companies to access finance from available potential investors.

Consolidation:
Small-scale off-grid businesses will need to merge to form larger entities to access future opportunities in the sector. The mergers will also enable them to achieve a significant reduction in operation cost, access capital and reduce financing cost. Consolidation will also allow businesses to leverage each other's strengths to improve service delivery and operational efficiency.

Policy Support:
While governmental policies in recent times have been focused on decentralizing power supply, a lot still has to be done in terms of policy to stimulate growth in the industry. The government needs to make policies that discourage the use of unclean fuel in distributed power generation while encouraging the use of clean energy sources. Policies also have to be made to minimize the risk of grid encroachment in areas where mini-grids have already been deployed. Such policies should include adequate compensation for mini-grid businesses during grid expansion and/or ensuring that mini-grids investors have recouped their investment before expanding the grid to their locations. Regulatory bodies also have to ease the off-grid licensing process to allow new businesses to acquire necessary permits at a faster rate.

Fiscal Incentives:
Huge capex requirement remains a key challenge in the economics of off-grid businesses in Nigeria. The government needs to grant incentives like import duty waivers and Value Added Tax (VAT) exemptions on renewable energy project materials to off-grid energy businesses to help reduce project costs. The cost savings from such incentives should be transferred to customers as lower tariffs to stimulate demand.

Environmental Sustainability:
As part of its commitment to the COP21 agreement, the Nigerian government intends to keep its carbon at 2 tonnes CO2e. To achieve this target, Nigeria has to be consistent in the use of clean energy generation as an alternative to fossil fuels in power generation. This commitment is expected to drive migration from the use of dirty fossil fuels to clean fuels for power generation in Nigeria.

References

1. "Access to Electricity (% of Population)."The World Bank, https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS?loca-tions=NG. Accessed July 2018.

2. "Electric power consumption (kWh per capita)." The World Bank, https://data.worldbank.org/indicator/EG.USE.ELEC.KH.PC?loca-tions=NG. Accessed July 2018.

3. "Mini-grids". Rural Electrification Agency, http://rea.gov.ng/mini-grids/. Accessed July 2018

4. "Power Generation in Nigeria". Nigerian Electricity Regulation Commission, http://nercng.org/index.php/home/nesi/403-generation. Accessed July 2018

5. "Transmission". Nigerian Electricity Regulation Commission, http://nercng.org/index.php/home/nesi/404-transmission. Accessed July 2018

6. "Generation". Niger Delta Power Holding Company Limited, http://ndphc.net/?page_id=601. Accessed October 2018

7. "Nigeria Power Fact Sheet". Power Africa, https://www.usaid.gov/sites/default/files/documents/1860/NigeriaPA.2018.04.508.pdf. Accessed October 2018

8. Siat Sustainability Report 2016. Siat Group, http://www.siat-group.com/downloads/sustainability-report-2016/

9. Siat Sustainability Report 2017. Siat Group, http://www.siat-group.com/downloads/sustainability-report-2017/

10. Facts and figures on NLNG 2018. Nigeria Liquefied Natural Gas, http://www.nlng.com/Media-Center/Publications/2018%20FACTS%20AND%20FIGURES%20ON%20NLNG.pdf


STERLING GENERATORS PVT.LTD.

All On is an impact investing Company seeded by Shell that invests in companies providing access to commercial energy products and services for under-served and un-served off-grid markets in Nigeria, with a special focus on the Niger Delta. All On seeks both financial returns and social impact - to provide and/or improve access-to-energy for millions of households and SMEs.

For more information, please contact:

all-on-communications@all-on.com

@AllonEnergy

www.all-on.com