



CONFLOW CONTINENT LIMITED & CONFLOW POWER GROUP UK

Working paper for discussion to create first presentation to exploit the Conflow suite of technology in Nigeria.



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Critical path to action

Nigeria's energy crisis

Nigeria has failed to solve its energy crisis despite the power sector's privatisation in 2013. We highlight 9 companies that are now rising to the challenge and providing unique solutions across the value chain. With more capital investment, these companies could reshape Nigeria's power sector.

As we highlighted previously, power remains a major pain point in Nigeria with various challenges across the energy value chain. These include inadequate power generation, loss of power generated, poor electricity distribution, debt-laden distribution companies, poor populace that cannot afford to pay the cost reflective tariff and a serious pollution problem from the millions of off-grid generator sets.

Although Nigeria has failed to solve its energy crisis (despite the power sector's privatisation in 2013), various companies are now rising to the challenge providing unique solutions across the value chain. From generation (Rensource, Lumos Nigeria, GVE), supporting other industries (Arnergy Solar, Daystar Solar) and manufacturing (Auxano Solar) to smart meters (Mojec Power, Momas Electricity Meters) and tech solutions to manage energy consumption and utilisation (Auxano Solar).

In this report, we highlight nine companies that are reshaping the Nigerian power sector, what they are doing, the challenges they face and how they have been able to fund these solutions.



Powering
SMEs and rural
communities



Supporting
Industries



Solar PV
manufacturer



Metering



Data and
technology



The future of power in Nigeria is decentralised. While attention remains on scaling up the capacity and the efficiency of the national grid, Nigeria's off-grid capacity continues to grow and service the excluded and underserved majority. Just as the world is shifting towards renewable energy, the fast-growing adoption of solar energy in Nigeria points to a future of less pollution and better access to power across the board.

Nigeria received US\$203.3mn (according to the International Renewable Energy Agency) in the last decade for off-grid solutions and has been the largest recipient of off-grid investment in Sub-Saharan Africa in recent years. Although we have seen more investment flow, we note that there is still a huge financing gap for off-grid solutions and Nigeria needs billions of dollars more in investment.

Generation: Augmenting the national grid with clean energy

The Nigerian electricity grid has a total installed generation capacity of about 10,500MW but less than 4,000MW is eventually distributed. Individuals and businesses must rely on costly, noisy petrol- or diesel-powered generator sets that are extremely bad for the environment.

To address this challenge, solar companies are taking advantage of the high solar radiation in the country to offer cleaner alternatives to household and businesses across the country. We highlight three companies — Rensource, Lumos Nigeria and Green Village Electricity (GVE) Projects Limited — under this segment.



RENSOURCE

Rensource is a solar off-grid energy company powering markets across Nigeria. It is currently active in 10 markets across six states with plans to set up operations in 100 markets across all 36 states in the country. The company provides power as a service and requires customers to pay just a monthly fee to stay connected. Rensource raised US\$20mn in Series A round led by CRE Venture Capital in 2019 to expand its operations across the country.



LUMOS NIGERIA

Lumos Nigeria is a subsidiary of Lumos Global. The company recently launched two solar energy solutions (Lumos Prime and Lumos Eco) in partnership with MTN to supply medium-sized households and business solar systems. Lumos kits are made up of solar panels and batteries that can store enough power to charge small everyday appliances like lamps and laptops. The unique selling point is clean and affordable energy. Recently, the solar company secured a US\$35mn funding from the US International Development Finance Corporation (DFC). Lumos Nigeria also receives support from the Rural Electrification Agency (REA) and funding from the Nigeria Electrification Project (NEP) to electrify one million households in Nigeria by 2025.





GREEN VILLAGE ELECTRICITY (GVE) PROJECTS LIMITED

GVE provides energy to underserved and off-grid rural communities, which suffer more from the inadequate power supply in Nigeria because the investment case for connecting the communities to the grid is usually not strong enough. GVE is addressing this by providing mini-grid solutions to rural communities across seven states and intends to reach 500 communities by 2022. The business model requires customers to pay a one-time connection fee and a fixed monthly charge to have access to 24/7 electricity. The company has so far received funding from All On (funded by Royal Dutch Shell), REPP Energy (funded by the UK's Department for Business, Energy and Industrial Strategy), Bank of Industry (Nigeria's DFI) and ElectriFI (EU-funded impact investment facility).

Challenges: The major challenge within this segment of the market is the route to profitability. The huge initial capital outlay as well as scale of adoption are the barriers to achieving profitability now. Most of the funding (thus far) has come from impact investors that are interested in Nigeria's renewable energy potential.

Supporting industries

Businesses and industries are not excluded from Nigeria's power sector rot — it is one of the major operational challenges. While most manufacturers rely on diesel generators and some have special arrangements with independent power producers (IPPs), the listed companies below have started embracing solar solutions to make it easier to service businesses and industries.



ARNERGY SOLAR


Arnergy is an off-grid energy provider in Nigeria with an installed capacity of over 2.5MW and a storage capacity of over 7.5MWh. Their target market includes (but not limited to) healthcare, education, hospitality, agribusiness and micro businesses. The company raised US\$9mn in 2019 to fund its solar mini-grid project.



DAYSTAR SOLAR

Daystar provides solar-as-a-service (Saas) and power-as-a-service (Paas) to commercial customers in Nigeria and Ghana with a current capacity of 23MW. The unique selling point of the services provided is that clients do not need to incur any capital expenditure and the power supplied is more reliable than the national grid. So far, the company has set up over 200 solar systems and recently secured a US\$38mn Series B funding to grow its capacity to 100MW and expand operations to French West Africa (Ivory Coast, Senegal and Togo).

Challenges: The identifiable challenge in this segment is the infrastructure and capacity to service large industries at scale — there needs to be more capital investment. A partnership with local solar PV assembler could be beneficial in ramping up capacity.



The shift to renewable energy: Solar PV manufacturers

As more businesses and households adopt off-grid solar solutions to supplement the inadequate supply from the grid, the demand for solar photovoltaic (PV) panels, inverters and batteries has increased substantially. A majority of the solar panels in Nigeria are imported, and this comes with its own challenges. We highlight below Auxano Solar, a company that is attempting to fill in the supply gap by assembling solar panels in Nigeria.



AUXANO SOLAR

Auxano is the first privately-owned solar PV assembler in Nigeria and recently signed US\$1.5mn investment deal with All On (funded by Royal Dutch Shell). The company has an annual production capacity of 10MW and intends to add 50% more capacity with All On's investment. The funding will also accelerate distribution of its products across Nigeria.

Challenges: Solar panel assemblers also face the typical challenges of manufacturing in Nigeria such as logistics problem, sourcing for materials and insecurity (extra security cost to safeguard properties). Despite the levy imposed on the import of solar panels, solar PV assemblers still struggle to remain price competitive — this can be resolved with more funding and capacity expansion. There is still room for more local players in the market as the demand for solar PVs far outstrips supply.

Taking on the notorious metering problem

One of the major challenges hampering effective electricity distribution in the country is the low meter penetration. Only 38% of 10.4 million registered customers have electricity meters.

In a bid to solve this challenge, the Federal Government launched the National Mass Metering Programme (NMMP) and the Nigerian Electricity Regulatory Commission (NERC) introduced a Meter Asset Provider (MAP) scheme. The NERC has approved about 22 companies to undertake the meter distribution exercise across the country. Of the 22, the two companies we highlight below not just distribute meters but also assemble them in the country.



MOJEC POWER

A subsidiary of Mojec International Limited, Mojec is one of the first companies to introduce smart meters and prepaid meters in Nigeria. The company built a meter assembly plant with an annual production capacity of 1.2mn meters in 2013, the largest at the time. Currently, Mojec is an approved Meter Asset Provider (MAP) for 7 out of the 10 distribution companies (DISCOs) in the country and has the largest installation fleet in the country. Apart from the assembling capacity and first-mover advantage, Mojec has strengthened its place as the market leader through a tailored financial solution to promote metering across the country. By partnering with 8 banks, customers can now get a loan to purchase Mojec meters.



MOMAS ELECTRICITY METERS

Incorporated in 2011, Momas produces single- and three-phase STS modular meters and prides itself in using more than 50% local content in production. The company is an approved Meter Asset provider for 2 (Ibadan and Kano discos) out of the 10 DISCOs.

Challenges: Despite the unified effort by the government, NERC, DISCOs as well as the metering companies, the rate of installing meters remains low. Local meter assembly companies also face challenges such as price competition from cheaper imported brands. The federal government had initially placed a 35% levy on imported meters, but this was recently suspended in a bid to hasten meter distribution across the country. In addition to the challenging competitive terrain, recent FX liquidity issue has made material imports difficult and expensive — another setback for these companies.

Tech solutions to manage energy consumption and utilisation

Most households and businesses in Nigeria rely on at least one additional power source to augment the national grid, and distributed resources are already larger than grid capacity. In the process of managing two or more energy sources, energy as well as funds can easily be wasted. Here, companies like Shyft power are providing tech-based solutions to combat the challenge.



SHYFT POWER

Shyft provides technology that enables power consumers to track energy use across grid-edge, mini-grid and off-grid systems. The solution makes it possible for individuals to track energy use by source and the cost of electricity consumed, thereby promoting decentralised and distributed energy consumption. Shyft Power was a beneficiary of SoftBank's Emerge accelerator and has since raised over US\$1mn from various sources, Japanese-VC Kepple Africa Ventures being the most recent. The start-up actively promotes digitisation of solar assets to promote shared economy for energy resources.

Challenges: The major challenge here is adoption across the board. Although the value proposition is great, adoption is generally low and there is still a long way to go in getting households and companies to embrace tech solutions to cost saving and energy management.

Shell in Nigeria

As one of the world's leading energy companies Shell plays a key role in helping to meet the world's growing energy demand in economically, environmentally and socially responsible ways. Shell has a history of over 50 years in Nigeria and the largest footprint of all the international oil and gas companies operating in the country.

Shell has been active in Nigeria since 1937. Shell companies and investments have played a pioneering role in onshore, shallow and deep water oil exploration and production. Shell has also been at the forefront of gas development, producing and delivering gas to domestic consumers and export markets for over 40 years.



Our values

Our core values of honesty, integrity and respect for people form the basis of the Shell General Business Principles.

Our business activities in Nigeria

- The Shell Petroleum Development Company of Nigeria Limited (SPDC) is the largest Shell company in Nigeria and produced the country's first commercial oil exports in 1958. SPDC is the operator of a joint venture (the SPDC JV) between the government-owned Nigerian National Petroleum Corporation – NNPC (55% share), SPDC (30%), Total E&P Nigeria Ltd (10%) and the ENI subsidiary Agip Oil Company Limited (5%). It is focused on onshore and shallow water oil and gas production in the Niger Delta.
- Shell Nigeria Exploration and Production Company (SNEPCO) operates the Bonga field, Nigeria's first deepwater oil discovery. The Bonga facility has the capacity to produce more than 200,000 barrels per day of oil and 150 MM standard cubic feet of gas per day.
- Shell Nigeria Gas (SNG) is the only international oil and gas company to set up a gas distribution company in Nigeria to supply industry customers.
- Nigeria LNG (NLNG) is a joint venture incorporated in 1989 to produce LNG and natural gas liquids for export. It was Nigeria's first LNG project. Shell holds a 25.6% share, together with NNPC (49%), Total (15%) and ENI (10.4%).



Shell In Nigeria by numbers

- The SPDC JV's assets include around 50 producing oil fields, a network of approximately 5,000 kilometers of oil and gas pipelines and flowlines, five gas plants and two major oil export terminals (Bonny and Forcados)
- Bonga was Nigeria's first oil and gas project in water depths over 1,000 metres. It increased Nigeria's oil capacity by 10% when it began producing in 2005 and has production capacity of 200,000 barrels of oil per day and 150 million standard cubic feet of gas per day
- The NLNG plant at Bonny Island has six processing units (trains) with total processing capacity of 22 million tonnes a year of LNG and up to 5 million tonnes of natural gas liquids (LPG and condensate). NLNG accounts for approximately 7% of the world's total LNG supply.

Shell In Nigeria by numbers

Shell Companies in Nigeria (SCiN) are major contributors to the economy, not only through the energy they produce and the revenues they generate for the country, but also via their supply chains, local content and social investment.

In 2014 Shell-operated ventures in Nigeria produced an average of 739,000 barrels of oil equivalent per day (boe/d), with 578,000 boe/d from the Shell Petroleum Development Company Joint Venture (SPDC JV) and 161,000 from the Shell Nigeria Exploration and Production Company (SNEPCo). Shell Nigeria Gas (SNG) supplies natural gas to 85 industrial customers and the SPDC JV is the major supplier of gas to Nigeria LNG. SPDC's Afam VI power plant supplied approximately 18% of the nation's grid-connected electricity in 2014.

Nigeria depends on the oil and gas industry for approximately 90% of export income and 75% of overall government revenue.

SCiN make a major contribution to developing the country's human capital and contracting capacity. 90% of SCiN contracts were awarded to Nigerian companies in 2014.

SCiN pursue a variety of social investment projects, with a particular focus on community and enterprise development, education and health. Nigeria the largest concentration of social investment spending in the Shell Group.

- In 2014 Shell-operated ventures contributed \$202 million (Shell share \$93.6 million) to the NDDC as required by law
- \$112 million (Shell share \$34 million) was directly invested by the SPDC JV and SNEPCo in social investment projects

Collectively, this makes Nigeria the largest concentration of social investment spending in the Shell Group.

Read more about our contributions in Nigeria: 

Leading renewable energy companies in Nigeria

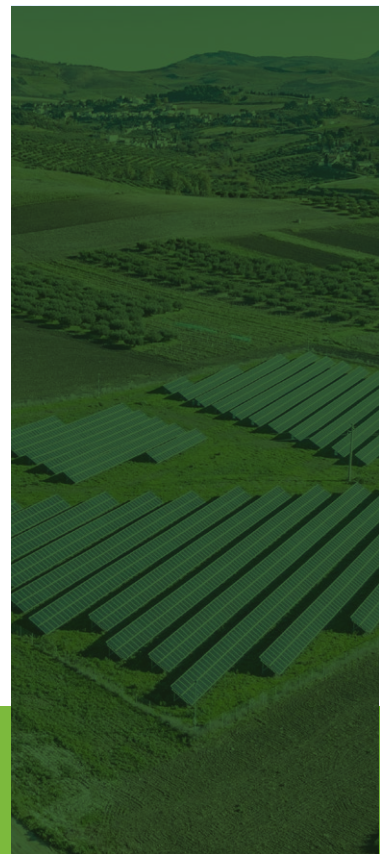


ASTRUM ENERGY

Astrum Energy is one of the leading renewable energy companies in Nigeria. It is a major solar energy service provider in the country. The company is one of the pioneer in the development of solar energy throughout Nigeria and beyond.

With over 20 years of experience behind them, Astrum Energy pride itself of delivering bespoke renewable energy projects with impeccable customer service at the core of their business. The company offers a complete range of Solar PV Powered Systems to suit every household and business.

“We provide great quality, high efficiency, and bespoke solar powered systems. We have formed relationships with a number of market leading manufacturers to achieve this mileage,” the company says on its website.



Astrum Energy offers designs, installation, testing and commissioning services of very high quality renewable and sustainable energy efficient technologies, for homes, businesses and rural off-grid energy users. The renewable energy firm works with leading market players and agencies where possible, to provide power alternatives and promote Eco-friendly environment



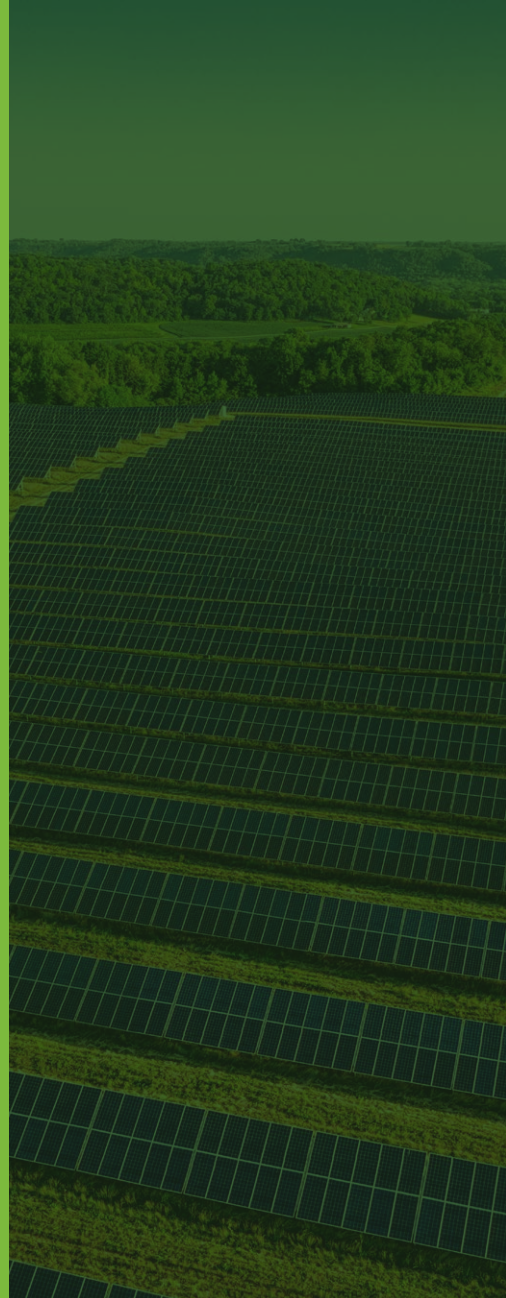
GREENPOWER OVERSEAS LTD

GreenPower Overseas Ltd is an engineering project company with expertise in renewable energy, Power Electronic, HVAC and Electrical services delivering bespoke solutions across various sectors of Nigeria and West Africa Sub-Region, Covering Telecommunication, Hospitality, Transportation, Real Estate, Agriculture, Oil and Gas, Health Care and Government Infrastructure.

The company works with a dedicated team of management personnel, engineers and professionals, committed to research and development of renewable energy. Customer satisfaction and support is key in what they do.

The company covers all area of engineering services covering Design, Procurement, Installation, Operation, maintenance and consulting.

GreenPower GP partners with notable renewable energy and power generation companies across the globe in developing a practical approach to solving power and energy problems in Nigeria. Their services include: power pv solutions, power system solution, MEP contractor and power protection system.



UNITRONIX GLOBAL

UNITRONIX GLOBAL also one of the leading renewable energy companies in Nigeria. It is an indigenous Renewable Energy Technology/Alternative Power Solutions Company. The company was created with the zest to improve the lifestyle of its customers by offering a range of products and services distinctive for its superior quality that would meet the needs of all its esteemed customers.

Unitronix Global Co. Limited has partnership with World Class Solar Energy company, with the professional ability of technology and has produced many modern solar components. Their dedication to the philosophy of optimal customer satisfaction in all their products has led to the focus on developing products with the latest technology and the most eco-friendly materials to meet the growing demands of our performance-conscious customers and society.



ECOZAR TECHNOLOGIES

Ecozar Technologies is a leading solar energy company in Nigeria, founded over a decade ago the company has since done solar power and inverter installations in homes and corporate premises across Nigeria. The company specializes in designs, installations and maintenance of high-quality solar energy systems, and inverter battery backup solutions. It delivers reliable power solutions that economically sustainable and can be tailored to each client's unique need and specification.

The company is made up of dedicated renewable energy professionals and engineers who ensure the power needs of our clients, are well met and at the most affordable rate, and also provide 24 hours support of the infrastructure when needed.



WAVETRA ENERGY

Wavetra Energy is a leading renewable energy company in Nigeria. The company specializes in solar power system installation. Its Wavetra Energy Academy is Nigeria's number solar training institute. The company has partnered with Federal and State governments, private agencies and companies to provide solar power solutions and training programs for skill acquisition and youth empowerment.

The company is very conscious of the environment in all our activities and it adopts an Environmental Management System in accordance with the International Standard ISO 14001.

Wavetra Energy is the recipient of the Most Efficient Renewable Energy Brand Award in Nigeria, 2018.



BBOXX

BBOXX is a British renewable energy company that designs, manufactures, distributes and finances decentralised energy solutions. It operates in a number of African countries including Nigeria and Kenya.

BBOXX provides off-grid communities in the developing world with smart, affordable, clean energy solutions. As a vertically integrated company we are in part a technology provider, as well as an operational distributed-energy service business.

BBOXX has a relentless dedication to innovation across the business. Their advanced, next-generation hardware and software are designed and manufactured with a quick route to market and receive direct feedback from operations to our engineering and quality control teams.



SOLARWOX RENEWABLE ENERGY LTD

Solarwox Renewable Energy Ltd is a creation of former renewable energy executives of leading global energy and technology companies such as Tesla USA and SolarCity USA.

The company says that it is in Nigeria to showcase excellence and exceptionalism in their dealings with the people and government through their deep knowledge of the solar renewable energy and technology backbone.

Their desire, they say, is to make our footprint in-grafted with professionalism and service excellence in design, build, installation and maintenance of solar projects.

Link to potential partners in Nigeria:



The mini grid sector in Nigeria started to develop only recently. The study focuses on mini grids defined as small, privately-owned and operated systems with generation of up to 10 megawatts (MW) capacity and a network that distributes power to several customers. The report is to provide a cross-country comparison of these topics: it examines side by side how each of the countries studied have responded to a specific regulatory question, and presents a decision-tree approach to developing regulatory frameworks for mini grids. This document is structured as follows: (i) Section 1 starts with brief introduction; (ii) Section 2 has brief description of the context of the country; (iii) Section 3 sets out an overview of the power sector; (iv) Section 4 examines the main aspects of the policy setting for mini grids; (v) Section 5 surveys technologies and business models used in the mini grids sector; (vi) Section 6 explains the process to authorize mini grid operators; (vii) Section 7 assesses technical and service standards for mini grids; (viii) Section 8 explains tariff setting, financing, and subsidies; (ix) Section 9 describes handling the relationship with the main grid; and (x) Section 10 concludes with a summary of lessons learnt from the experience of the country.

Citation

“Energy Sector Management Assistance Program. 2017. Mini Grids in Nigeria : A Case Study of a Promising Market. World Bank, Washington, DC. © World Bank. <https://openknowledge.worldbank.org/handle/10986/29016> License: CC BY 3.0 IGO.”

The transmission system in Nigeria comprises 330 kV and 132 kV circuits and substations. The thermal generation is located in the south of the country, generally near to the sources of gas, while the hydro generation is located further north at Jebba, Kainji and Shiroro.

Read more here:



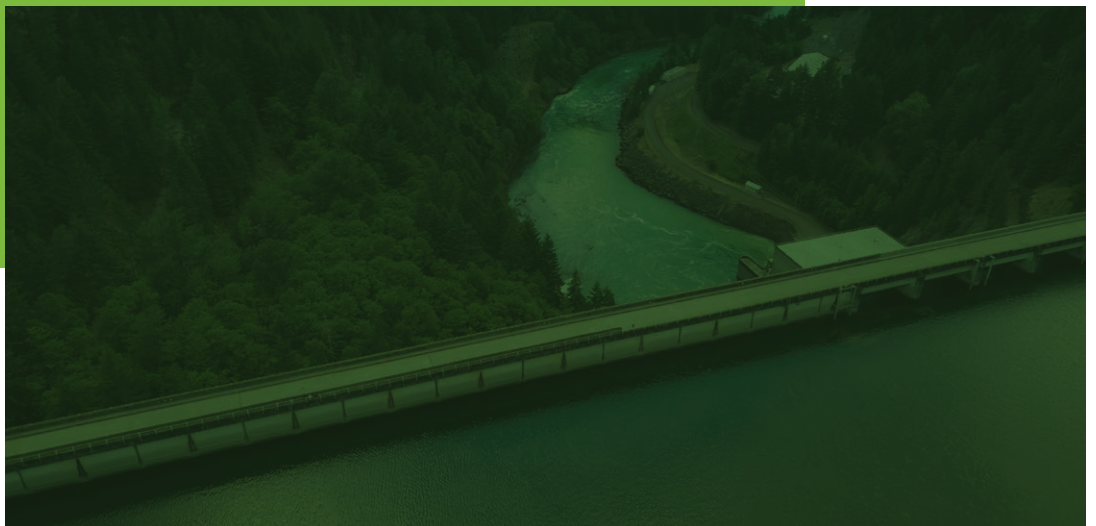
May 2021

Nigeria electricity national grids don collapse and some parts of di kontri don enta darkness.

Transmission Company of Nigeria (TCN) say di kontri experience total system collapse wey cause voltage collapse for some parts of di grid at 11:01 am on Wednesday. Three electricity distribution companies, Ikeja electric, Kaduna electric and Eko electric confam say dem dey experience power outage.

TCN say dem immediately begin grid recovery around 11:29 am and now, power don dey gradually return to oda parts of di kontri.

Rocky Mountain Institute, Abadan Electricity Distribution Company (IBEDC) and Nayo Tropical Technology have partnered to bring Nigeria's first rural commercial undergrid mini-grid online. With support from the Nigerian Rural Electrification Agency, the three organisations have joined forces to accelerate the commercial deployment of undergrid mini-grid technology in the Nigerian sector.



Read more here:





The Mokoloki project demonstrates a financially viable business model that could provide electricity access to millions living in underserved rural communities throughout the country. Ahmad Salihijo, CEO of the Nigerian Rural Electrification Agency, says part of their work is to create an enabling environment for private sector-led projects to thrive. Thus he is delighted to observe this kind of strategic collaboration geared towards accelerating energy access for the unserved and underserved communities in Nigeria.

“What makes this project unique, beyond being Nigeria’s first commercial undergrid mini-grid in a rural community, is the social and economic transformation that the project ultimately brings to the Mokoloki community. I commend RMI, IBEDC, Nayo Tech and all other stakeholders involved in carrying out this feat,” said Salihijo.

Throughout sub-Saharan Africa, hundreds of millions of people live “under the grid”. Such communities are within distribution company territory but receive unreliable, inconsistent or low-quality power that does not meet their needs, or no power at all. These communities are undergrid, yet also underserved. An opportunity exists to better serve these communities through mini-grids which use existing distribution and incorporates distributed energy sources. RMI defines these systems as undergrid mini-grids.

IBEDC was the first Nigerian distribution company to initiated a tripartite contraction negotiation with a rural community as required for interconnected mini-grids by regulation. A rural community in Ogun State, Mokoloki, was struggling with intermittent electricity access and poor voltage quality prior to this project. However, its bustling market and proximity to main trade routes promised major commercial activity, making it an ideal site for the undergrid mini-grid.

“By the time this project [stabilises], Mokoloki will be like a town. They will have more regular power supply than cities,” said Engr. John Ayodele, IBEDC chief operating officer.


“We are excited to be in the forefront of undergrid minigrid development in Africa as a scalable and sustainable business opportunity with good social impact on our host communities,” said Anayo Okenwa Nas, chief executive officer of Nayo Tech.



Implementing the under-grid mini-grid

This undergrid mini-grid pilot embodies recommendations from recent reports by RMI and partners at EMRC, CLeantech Hub and All On.

Under the Grid outlines the business opportunities for undergrid mini-grid development in sub-Saharan Africa, while Electrifying the Underserved expands on specific business models to guide project implementation. An estimated 40 million rural residents are underserved by the main grid in Nigeria. Of these, close to 35% could be served by over 4,000 commercially viable undergrid mini-grid systems. Nationwide, the revenue opportunity from these mini-grids is approximately N400 billion (\$1 billion) per year

Read more here: 

Extract: An Overview of Nigeria's Energy Subsidies

WHAT IS AN ENERGY SUBSIDY?

Commonly, energy subsidies are defined as “any government action that lowers the cost of energy production, raises the revenues of energy producers or lowers the price paid by energy consumers” (ieA, organization of the Petroleum exporting countries [oPec], organisation of economic co-operation and development [oecd] & World bank, 2010). energy subsidies come in two main categories: those designed to reduce the cost of consuming energy, called consumer subsidies, and those aimed at supporting domestic production, called producer subsidies (burniaux et al., 2009, as cited in ellis, 2010).


Within these categories, energy subsidies come in different forms. the united nations environment Programme (uneP), oecd and the ieA identify the following typical mechanisms by which governments support the production and consumption of energy (uneP & oecd/ieA, 2002; uneP, 2008):

- direct financial transfers: grants to consumers, grants to producers, low-interest or preferential loans and government loan guarantees.
- preferential tax treatment: tax credits; tax rebates; exemptions on royalties, duties or tariffs; reduced tax rates; deferred tax liabilities; and accelerated depreciation on energy-supply equipment.
- trade restrictions: tariffs, tariff-rate import quotas and non-tariff trade barriers.
- energy-related services provided directly by government at less than full cost: government-provided energy infrastructure, public research and development.
- regulation of the energy sector: demand guarantees, mandated deployment rates, price controls, environmental regulations and market-access restrictions.

NIGERIA ELECTRICITY PRICES.

Nigerian Naira	23.590	38.530
U.S. Dollar	0.057	0.094

The power market in Nigeria is expected to grow at a CAGR of approximately 12.39% during the forecast period of 2019 – 2024. Nigeria is the biggest economy in the African continent, with USD 397.27 billion GDP recorded in 2018.

Read more here: 

Market Overview

The Nigerian power EPC market is expected to register a CAGR of more than 3% during the forecast period of 2021-2026. The COVID-19 pandemic has delayed several power projects in the country during Q1 and Q2 2020. However, factors such as increasing investment and supportive government policies are likely to drive the Nigerian power EPC market during the forecast period. The Nigerian power sector is dominated by thermal power generation, that too gas-fired, which accounted for over 80% of the total power generation in the country as of 2019. The transmission losses in Nigeria, across the network, are high at an average of approximately 8%-10%, compared to the emerging countries' benchmarks of 2%-6%. The Nigerian government is approaching foreign investment for power plant infrastructure to full fill the demand of the country. This, in turn, is expected to propel the Nigerian power market during the forecast period. However, geopolitical tensions and the high fiscal deficit coupled with a high inflation rate are expected to negatively impact the Nigerian power EPC market in the short term.




- Renewable energy is expected to witness significant growth in the Nigerian power EPC market due to the country's supportive government policies and upcoming renewable energy projects.
- Emerging markets such as distributed power generation, smart grids, and energy storage are expected to create ample opportunities for the players in the near future.
- The rise in domestic electricity demand led to increased electricity generation targets, which are likely to drive the demand for new power generation and T&D projects in the country during the forecast period.

Nigeria energy sector overview

Population: 195.87 million

GDP: \$397.27 billion

Nigeria is the largest economy in sub-Saharan Africa, but limitations in the power sector constrain growth. Nigeria is endowed with large oil, gas, hydro and solar resources, and it has the potential to generate 12,522 MW of electric power from existing plants. On most days, however, it is only able to dispatch around 4,000 MW, which is insufficient for a country of over 195 million people. Power Africa technical support to distribution companies in Nigeria helped them increase revenue by over \$250 million - money that can be reinvested into the distribution network, improving service and expanding access. The Nigerian power sector experiences many broad challenges related to electricity policy enforcement, regulatory uncertainty, gas supply, transmission system constraints, and major power sector planning shortfalls that have kept the sector from reaching commercial viability.

Full report here: 

GENERATION CAPACITY

- Installed Capacity: 16,384 MW
 - Hydro: 2,062 MW
 - Gas: 11,972 MW
 - Wind: 10 MW
 - Solar: 7 MW
 - Other/Diesel/HFO: 2,333 MW

Power Africa new MW to date at financial close: 3,043 MW

CONNECTIONS

- Current Access Rate(2): 60%
 - Urban: 86%
 - Rural: 34%

Power Africa new connections: 291,058

Electricity and Power Systems

This is a best prospect industry sector for this country. Includes a market overview and trade data.

Last published date: 2021-10-1

OVERVIEW

Unit: USD millions

Total Local Production	9.04	9.23	9.01
Total Exports	0.92	0.93	0.89
Total Imports	154.26	157.50	356.44
Imports from the U.S.	100.24	102.35	171.57
Total Market Size	162.38	165.79	158.49
Exchange Rate: 1 USD	362	360	379.50

(total market size = (total local production + imports) - exports)

Units: \$ millions

Source:

Total Market Size = (Total Local Production + Total Imports) - (Total Exports)

Data Sources:


Total Local Production: Independent Power Producers and other local sources such as Manufacturers Association of Nigeria, National Bureau of Statistics.

Total Exports: Independent Power Producers and other local sources such as Manufacturers Association of Nigeria.

Total Imports: Independent Power Producers and other local sources such as Manufacturers Association of Nigeria.

Imports from U.S.: U.S. Census Bureau, ITC Trade Map

*Estimates for 2021 based on estimated GDP trends across the sector



In 2013, the government of Nigeria (GON) privatized 11 electricity distribution companies (DISCOs) and six generating companies (GENCOs) while retaining 100% ownership of the Transmission Company of Nigeria (TCN) as part of a wider strategy to reform the sector and stimulate growth. The country's ongoing comprehensive power sector reforms are aimed at expanding capacity, increasing electricity access, and upgrading transmission.

Nigeria's power generation is mostly thermal and hydro with installed capacity of about 12,522 MW. The country is part of the Economic Community of West African States and part of the West African Power Pool (WAPP), a specialized agency of ECOWAS that includes 14 of the 15 countries in the regional economic community. WAPP was initiated to promote and develop power generation and transmission infrastructures as well as to coordinate power exchange among the ECOWAS member states. Nigeria currently supplies electricity to the Republic of Benin, Togo, and Niger.

The Nigerian power sector will require significantly more investment to achieve reliable power supply. Industry operators estimate that the country will require as much as \$100 billion in investment over the next 20 years to maintain current service. The World Bank is financing a \$486 million International Development Association credit for the Nigerian Electricity Transmission Access Project (NETAP), part of the Transmission Rehabilitation and Expansion Program (TREP). The goal of TREP is to support the rehabilitation and upgrade of Nigeria's electricity transmission substations and lines. This will expand the power transmission network and capacity, allowing distribution companies to improve reliability and supply to consumers. Following the roll out of TREP I, which is fully donor-funded, GON is currently sourcing funding for TREP II, to further increase transmission capacity. TCN has raised over \$1.6 billion through TREP.

Other ongoing programs include the Meter Assets Provider regulation which was implemented in 2018. The regulation aims to bring new money into the market to finance meter deployment, closing metering gaps (currently less than 50% of customers are metered), removing estimated billing and related issues, and beginning to alleviate collection-related challenges faced by the DISCOs. Under the differential power distribution policy, GON introduced “the willing seller, willing buyer” electricity distribution policy aimed at allowing electricity to be wheeled directly from the generating companies to willing consumers, including communities, commercial clusters, industrial areas, and hospitality sectors with capacity for full payment. Also, GON recently announced that it plans to sell about 2,000 MW of ‘unutilized’ stranded electricity from Nigeria to four West African countries of Niger, Togo, Benin, and Burkina Faso through the proposed \$570 million, 875 km, and 330 kv Northcore Power Transmission Line project. The Northcore project is funded by the World Bank, African Development Bank, and the French Development Council.



The Renewable Energy Master Plan was launched in 2011 and was aimed at increasing the share of renewable energy in the country’s energy mix by at least 13% by 2015, 23% by 2025, and 36% by 2030. It is expected that with current GON focus on renewable energy, the country will see significant growth to meet some of these targets. These energy mix targets will be comprised of:

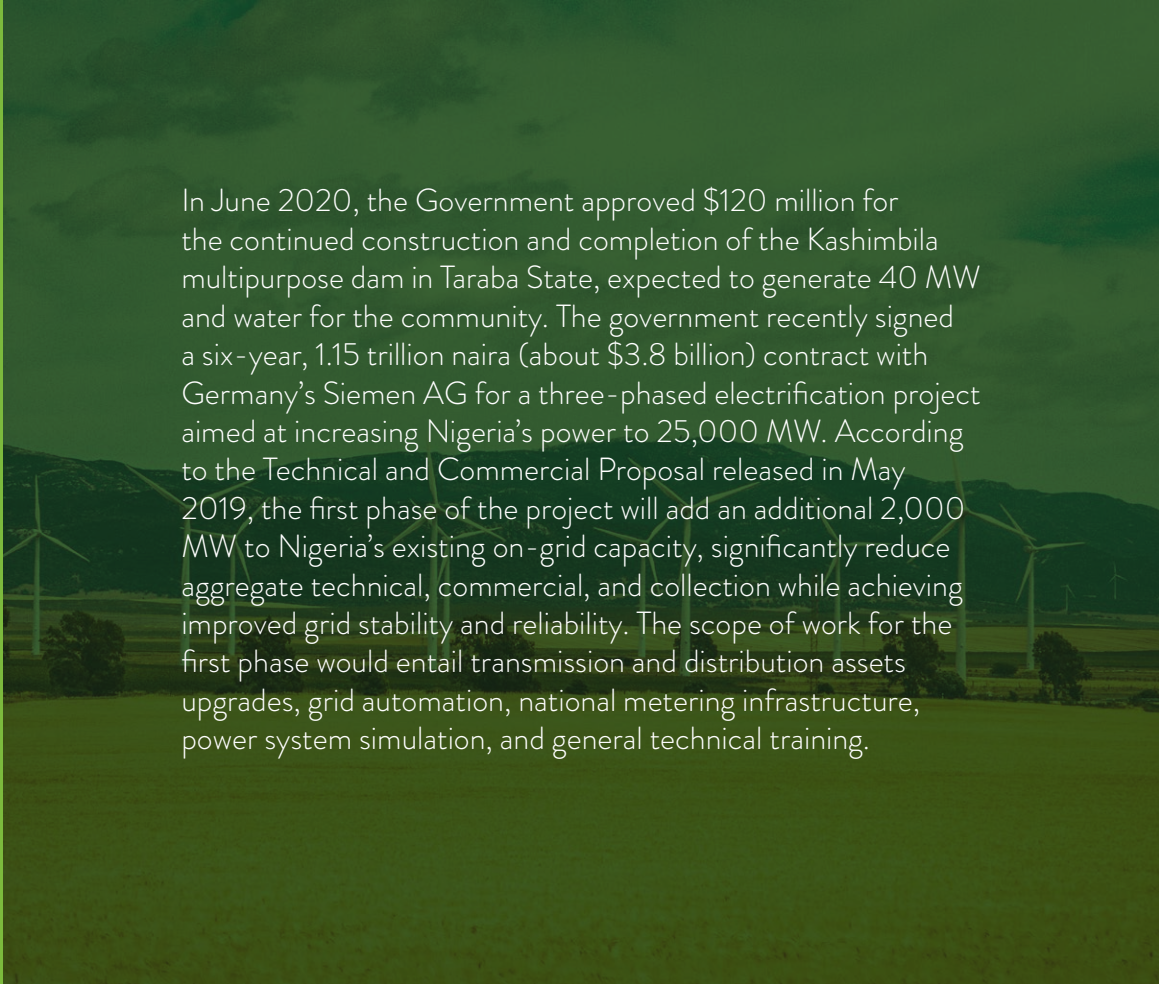
- 30% capacity from coal (2,200 MW)
- NIPP projects (1,896 MW)
- IPPs (296 MW)
- GON legacy assets (thermal (5.6 GW), hydro: (1.3 GW) and wind (10MW))

In addition, GON is also investing heavily to boost generation through large, medium, and small hydrostatic power plants with total capacity of over 6,024 MW, including:

- Mambilla (3,050 MW)
- Zungeru (700 MW)
- Gurara (11,360 MW)
- Lokoja (750 MW)
- Makurdi (1,000 MW)
- Small hydropower (84 MW)
- Itisi (40 MW)
- Kashimbila (40 MW)

Industry sources indicate that due to rapid population, Nigeria will need substantial additional generation capacity to meet demands through 2030. They foresee opportunities in distributed power generation, smart grids, and energy storage in the medium to long-term.

In June 2020, the GON rolled out a 2.3 trillion naira (\$5.9 billion) stimulus plan to help support the economy. International organizations are also providing support for Nigeria's power sector. The African Development Bank (already working with Nigeria on a \$410 million transmission project) pledges to invest an additional \$200 million through the Rural Electrification Agency (REA), to expand Nigeria's power sector and improve access to electricity. In 2020, the World Bank approved an additional \$750 million Power Sector Recovery Operation (PSRO) loan for Nigeria to achieve financial sustainability, enhance accountability, and ensure the supply of 4,500 MW/h of electricity to the grid by 2022. In 2019, the World Bank approved a \$550 million loan for Nigeria to develop mini grids and solar home systems based on its projections that the country's mini grid subsector was set to expand rapidly. The Power Sector Recovery Program (PSRP) was initiated in 2017 by GON, in collaboration with the World Bank, as an operational and financial intervention to review and address the power sector financial deficit.



In June 2020, the Government approved \$120 million for the continued construction and completion of the Kashimbila multipurpose dam in Taraba State, expected to generate 40 MW and water for the community. The government recently signed a six-year, 1.15 trillion naira (about \$3.8 billion) contract with Germany's Siemen AG for a three-phased electrification project aimed at increasing Nigeria's power to 25,000 MW. According to the Technical and Commercial Proposal released in May 2019, the first phase of the project will add an additional 2,000 MW to Nigeria's existing on-grid capacity, significantly reduce aggregate technical, commercial, and collection while achieving improved grid stability and reliability. The scope of work for the first phase would entail transmission and distribution assets upgrades, grid automation, national metering infrastructure, power system simulation, and general technical training.

The Nigerian National Petroleum Corporation's (NNPC) Abuja 1350-megawatt power plant, which received a \$1.16 million funding commitment from USTDA, is set to benefit from the Ajaokuta–Kaduna–Kano (AKK) gas pipeline being built. The power plant is being built by U.S. companies GE and Continuum Associates, in partnership with the NNPC. In addition to ongoing power projects in Nigeria, GON has signed a \$2 billion power production agreement with Siemens under the Presidential Power Initiative. The project is expected to boost Nigeria's electricity production to 25,000 megawatts by 2023. The NNPC plans to build two more power plants in Kano and Kaduna, bringing the total capacity of the three projects to 4600 MW of electricity production capacity.

Power Africa: Power Africa is a market-driven, U.S. Government-led public-private partnership aiming to double access to electricity in sub-Saharan Africa. It offers tools and resources to private sector entities to facilitate doing business in sub-Saharan Africa's power sector. The Electrify Africa Act of 2015 institutionalized Power Africa.

Learn more about the full Power Africa toolbox: 
or other opportunities offered by Power Africa: 

Power Africa Support: Power Africa has provided significant transaction assistance to the Government of Nigeria and private sector entities in accelerating landmark power projects, including Nigeria's first IPP which reached financial close in 2015 and added 450 MW to the grid. Since April 2018, Power Africa has facilitated the financial close of 1005 megawatts of generation capacity, achieved 1,845,681 new on grid and off-grid connections and unlocked \$1.48 billion in investments for on-grid generation, and off-grid projects in Nigeria. Power Africa also played a key role in assisting the Nigerian government in unbundling the electricity sector into six generation companies, eleven distribution companies, and the Transmission Company of Nigeria. Critical to this support has been the role of the Overseas Private Investment Corporation (OPIC) (now the U.S. International Development Finance Corporation (DFC)) in providing much needed investment funding for IPPs and U.S. Trade and Development Agency in modernizing distribution networks, while reducing technical and commercial losses. Without more generating capacity, it will be difficult to connect additional customers to the grid, thus Power Africa is supporting the growth of off-grid options including mini-grids and rooftop solar through technical assistance to electrify communities. Power Africa has developed various tools, business models, and guidance documents for the Nigeria Rural Electrification Agency (REA), investors, and private sector companies seeking to access the market.



Learn more about how Power Africa is partnering to address key challenges in Nigeria's electricity sector and supporting private sector investment in electrical power equipment here:



For more information, please contact us at: powerafrica@usaid.gov

Two major subsectors currently exist within the electrical power sector in Nigeria:

- Electrical equipment, and
- Renewable energy

Electrical Equipment Subsector

The electrical equipment segment is large and has a high potential for growth in the future. Electrical equipment such as electrical wires, power generating machines, inverters, transformers, conductors, meters, switch gears, capacitors, distribution boards, and voltage regulators are all used in Nigeria on a large scale. Most of the demand for electrical equipment in Nigeria is met by foreign countries, due to low production capacity and expertise in the country.

Renewable Energy

In 2006, GON initiated the Renewable Energy Master Plan (REMP) aimed at increasing the supply of renewable electricity (wind, solar, biomass and small hydro) from 13% of total installed electricity generation capacity in 2015 to 23% in 2025 and 36% by 2030. The country also expects to add 30% capacity from coal with the objective of increasing the country's power generation capacity to 10,000 MW.

With over \$12 billion spent per annum on electricity at a cost of 140 naira per kWh or \$0.35/kWh, there is a market for less expensive, off-grid power solutions for companies and households in Nigeria. With local companies working to fill this gap, there is high demand for equipment such as solar panels, installation equipment, distribution equipment, and batteries. as part of their solutions. Due to the lack of production capacity for such equipment in the country, U.S. manufacturers have an opportunity to export such equipment to the companies operating in this segment of the market.





Currently, the energy mix in Nigeria is dominated by thermal (80%) and hydro (20%) power generating sources. GON has embraced the use of renewable sources such as biomass and solar to produce electricity mostly for rural and semi-urban areas that are out of the reach of distribution companies. GON, through the Rural Electrification Agency, has actively been commissioning electrification projects since 2014, using solar energy as the main source of electricity. According to the agency's impact report released in January 2019, the REA recorded over 99,450 connections in a 20-month period and sourced over \$550 million in funding for investment in rural areas and market areas in the country.

Solar: Nigeria is estimated to have about 427 GW of solar power potential, although current generation capacity is estimated at 5GW. In 2016, the country signed a Power Purchase Agreement (PPA) worth \$2.5 billion with 14 independent power producers for solar power plants across the country, expected to add about 1.1 GW of power to the grid. However, these projects are stalled due to several issues, including tariff structures and concerns about the capacity of the current transmission infrastructure to accommodate the additional power generation. Industry experts believe that the best potential lies in the smaller micro-grid projects which are best suited for the northern parts of Nigeria. There is a growing uptake of off-grid solar power installations to replace more expensive diesel generators across the country, both for commercial and industrial applications. Over 50 MW of solar capacity has been installed over the last five years. The Rural Electrification Agency, with \$550 million funding support from the World Bank and the African Development Bank, is helping to expand energy access through the Solar Power Naija initiative. This initiative aims to provide 5 million new connections to 25 million individuals in off-grid communities. Power Africa has been instrumental in helping suppliers of solar home systems better understand and enter the Nigerian market.

HYDRO:

Nigeria is estimated to have a total exploitable large-scale hydro power potential of over 14,120 MW, capable of producing 50,832 GW of electricity annually. The potential for small hydro power is estimated at 3,500 MW, of which only 60.58 MW (about 1.7%) has been developed. The country's hydroelectric energy is about 20% of installed capacity. Studies estimate that there is potential for 11,500 MW in large hydro power plants and up to 730 MW in small hydro-power projects.

BIOMASS:

GON, through the national oil company the Nigerian National Petroleum Corporation (NNPC), has a renewable energy division that has mapped out biomass opportunities in the sector and has a mandate to expand the automotive biofuels industry. NNPC intends for projects to be executed as a Public-Private-Partnership (PPP), with NNPC as a minority shareholder. Plans include using sugarcane and cassava as key biomass raw materials. However, this has been stalled due to a lack of appropriate legislative framework and appropriate equity financing.

WIND:

Nigeria has great potential for onshore wind power generation. A100 MW wind power project is already under development, while offshore wind resources are being evaluated and mapped out.

COAL:

Nigeria is estimated to have coal reserves of up to two billion metric tons and coal-fired electrical power is being explored by the GON as an additional source of power. GON plans to expand generation by about 11,000 MW through the addition of six coal-fired power and nine gas plants by 2037.

The coal plants expected in 2034:

- Ramos (1000MW)
- Ashaka/TPGL (500 MW)
- Nasarawa (500 MW)
- Ashaka (64 MW)

The coal plants expected by 2037:

- Benue (1200 MW)
- Enugu (2000 MW)

HTG-Pacific Energy (a Chinese consortium) signed an MoU with the GON for the exploration and mining of coal bricks. The MoU is expected to be followed by a Power Purchase Agreement (PPA) which will boost investors' confidence in the 1,000 MW, coal-fired plant project. However, the absence of infrastructure in both the power and mining sectors, coupled with lack of skilled coal mining labor, may hinder the development of large-scale, coal-fired power in Nigeria

Opportunities

Self-generation for power remains widespread, which significantly increases costs of doing business. Nigeria presents a significant opportunity for U.S. manufacturers and suppliers of diesel-operated generating sets (20-500 KVA). Until service is improved, corporate offices, service providers, and individuals must generate their power (ranging from 20 KVA to 500 KVA) and U.S. diesel-operated power equipment is preferred. However, various opportunities exist in utility grids, including transmission and distribution (T&D) network upgrades, expansion of infrastructure, metering, billing, collection, and prevention of theft and loss.

There are tremendous opportunities for U.S. companies in Nigeria's power sector. However, U.S. companies still face competition from Chinese, U.K., French, German, Indian, and Korean companies for projects and sale of electrical equipment in the Nigerian market. The country's growing population and its ambition to become an industrialized nation continues to increase its power infrastructure needs. There are opportunities for U.S. companies in equipment export as well as training and technical services.

Government Opportunities

According to the National Integrated Infrastructure Master Plan (NIMP), the power sector accounts for the largest proportion of proposed investments over the next thirty years in Nigeria. The \$3.8 billion Siemens agreement is an indication that the government will increase spending in the electricity segment. The government is also developing IPPs to increase the country's production capacity.

U.S. firms interested in the power sector are encouraged to explore opportunities in the following areas:

- Building of transmission and distribution infrastructure, including construction of a transmission infrastructure to wheel increased power generated by GENCOs and sold to DISCOs. This is expected to enhance Nigeria's national grid and enable independent power plants to interconnect and sell their power.
- Joint venture partnerships to build off-grid captive power plants (5–19 MW) for resale to manufacturing industries in strategic cities (GON power reforms allow off-grid sales of generated power)
- Partnerships offering technical services to newly privatized GENCOs and upgrading of existing equipment (turbines, generators, and ancillary systems)
- Renewable energy (RE) systems: solar, wind, biomass technologies
- Technical services to DISCOs for proper metering and billing systems
- Supply of prepaid meters to DISCOs
- Training of GENCO and DISCO technical personnel for maintenance of equipment
- Sale of heavy-duty generators (100 KW to 1 MW): Most companies operating in Nigeria provide their own reliable source of power such as diesel-operated heavy-duty generating sets. U.S. and European-origin equipment are preferred in view of its reliability and serviceability. U.S. manufacturers of power equipment may utilize the guarantees provided by Ex-Im Bank and U.S. Development Finance Corporation as incentives to purchase generators from the United States. Ex-Im Bank has put forth a plan to provide up to \$1.5 billion in financing and guarantees in the Nigerian power sector.

Support Services

- Provision of specialized training for electricity industry technicians and managers.
- Assembly Plants for intermediary power equipment and accessories, including meters
- Consultancies in regulatory and consumer education initiatives
- Provision of power sector specific equipment testing, calibration, and logistics services
- Smart metering devices, both manufacturing and servicing
- Manufacturing of electricity generation, transmission, and distribution equipment/spare parts



Local Trade Events

- The Nigeria Energy Forum - Advancing Clean Energy Sustainability (thenef.org)
- Nigeria Energy, <https://www.nigeria-energy.com/en/home.html>,
- International Power Engineering Exhibition and Conference (IPECON <https://10times.com/ipecon-abuja>)(Hybrid)
- Future Energy Nigeria (<https://www.future-energy-nigeria.com/>), (virtual)
- Nigeria Alternative Energy Expo

Key Agencies in the Nigeria Power Sector

- Federal Ministry of Power, Nigeria – Policy formulation and consistency
- Nigeria Electricity Regulatory Commission – Issuance of licenses and regulation
- Nigeria Bulk Electricity Trading Company Plc – Power purchase agreements
- Nigeria Electricity Liability Management Company – Mandated to take over management and settlement of power purchase agreement obligations and other legacy debts.
- Bureau of Public Enterprise -Support privatization of Nigerian legacy assets
- Gas Aggregation Company of Nigeria – Allocation of gas for domestic use
- Transmission Company of Nigeria – Management of the national grid
- Nigeria National Petroleum Company – Gas infrastructure and transportation
- Rural Electrification Agency – Remote and off grid projects
- Nigerian Electricity Management Services Agency– Testing and certification of electrical components for quality and suitability
- Advisory Power Team (Vice President's Office) – Facilitating cross-sector solutions
- Federal Government of Nigeria Power Company - power project supervision and monitoring

For more sector information, e-mail: Benedicta N. Nkwoh, U.S. Commercial Service, U.S. Consulate General, Lagos, Nigeria at **Benedicta.Nkwoh@trade.gov**

This is a working paper to highlight key factors and factors for CC to enter the power sector in Nigeria.

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