

ENERGY
CATALYST

Country Guide: Nigeria

June 2020



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Figure 1 Sandfill Bus Stop, Ozumba Mbadiwe Road, Lagos, Nigeria (Photo by Zenith Wogwugwu on Unsplash)

Nigeria, officially addressed as the Federal Republic of Nigeria, is the most populous country on the African continent. Nigeria is located in the west of Africa, bordering the Gulf of Guinea in the south, the Republic of Benin in the west, Chad and Cameroon in the east and Niger in the north. Since 1991, its capital has been the centrally located city of Abuja, with the Nigerian government previously headquartered in Lagos. Temperature across the country is relatively high with a very narrow variation in seasonal and diurnal ranges. There are two basic seasons: wet season, which lasts from April to October, and dry season, which lasts from November till March.



Figure 2 Map of Nigeria. Source: d-maps

A key regional player in West Africa, Nigeria accounts for about half of West Africa's population with approximately 195 million people and one of the largest populations of youth in the world. Nigeria is a multi-ethnic and culturally diverse federation which consists of 36 autonomous states and the Federal Capital Territory. With an abundance of natural resources, it is Africa's biggest oil exporter, and has the largest natural gas reserves on the continent.

The country held national elections in 2019 for the sixth consecutive time since its return to democracy

Table 1: Nigeria at a glance

Capital	Abuja
Total Area	923,768 km ²
Population	195 million (2018 estimate)
Official languages	English
Rural Population	49.6% (2018)
GDP	US \$ 397,270M (2018)
GDP Per Capita	US \$ 2,028 (2018)
Currency	Naira (NGN)
Exchange rate 01/03/2020	1 GBP = 465.25 NGN
Exchange rate 01/03/2018	1 GBP = 496.51 NGN
Access to Electricity	60.6% (2017)

in 1999. The incumbent president, Muhammadu Buhari, won the elections and was sworn in for a second term on May 2019. He has identified fighting corruption, increasing security, tackling unemployment, diversifying the economy, enhancing climate resilience, and boosting the living standards of Nigerians as the main policy priorities his government seeks to continue to pursue in his second term up till 2023.

Economy

Oil price volatility continues to influence Nigeria's growth performance. Between 2000 and 2014, Nigeria's gross domestic product (GDP) grew at an average rate of 7% per year. Following the oil price collapse in 2014-2016, combined with negative production shocks, the gross domestic product (GDP) growth rate dropped to 2.7% in 2015. In 2016, during its first recession in 25 years, the economy contracted by 1.6%.

While Nigeria has made some progress in socio-economic terms in recent years, its human capital development remains weak due to under-investment, and the country ranked 152 out of 157 countries in the World Bank's 2018 Human Capital Index. Nigeria also continues to face massive developmental challenges, which include the need to reduce the dependency on oil and diversify the economy, address insufficient infrastructure, and build strong and effective institutions, as well as solve governance issues and improve public financial management systems.

Nigeria is a member of 57 international organisations including the African Union, the United Nations, Commonwealth of Nations, Economic Community of West African States and the African, Caribbean, and Pacific Group of States (ACP).

In the 2020 yearly World Bank survey on "Doing Business", a comparison of business regulation in 190 economies, Nigeria moved up 15 places from its 2019 spot and has been tagged as one of the most improved economies in the world for running a business. The 2020 edition of Doing Business ranks Nigeria as 131 out of 190 economies with a score of 56.9 out of 100 in the ease of doing business. Other indicators of the survey that Nigeria has improved on include scorings for starting a business, dealing with construction permits, getting electricity, registering property, getting credit, protecting minority investments, paying taxes, trading across borders, enforcing contracts and resolving insolvency. Figure 3 provides a comparison of Nigeria to similar economies for starting a business.

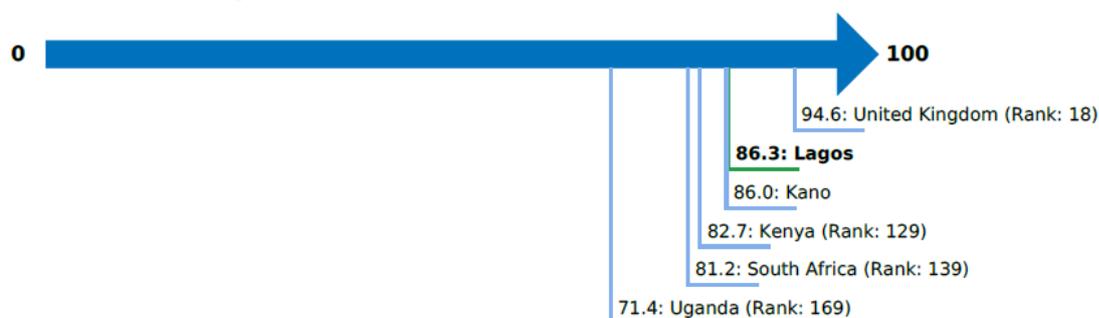


Figure 3 Doing Business 2020 score for starting a business. Data from: World Bank Group, 2020

The energy sector in Nigeria

Nigeria has 12,500 MW of installed generation capacity, being largely dependent on hydropower and fossil (gas) thermal power sources (12.5% and 87.5% respectively). It should be noted, however, that currently only 3,500 MW to 5,000 MW is typically available for onward transmission to the final consumer. Based on this scenario, the country's energy sector could be deemed as being in crisis, with the extensive losses attributable to non-availability of the installed capacity and a very high occurrence of significant technical and non-technical issues through the power supply value chain. Due to the unreliability of the national grid, a significant number of businesses possess generators. Statistics on this captive generation capacity are not readily available, but estimates are as high as 14-20 GW.

In response to this, in 2013 the Government of Nigeria completed an extensive nine-year-long process of power sector reforms centred on the privatisation of the country's main generation and distribution assets. In addition, to tackle the supply and distribution crisis, 15 government-owned generation and distribution companies were sold to private owners in 2015.

Off-grid electrification initiatives in Nigeria are gradually emerging. In February 2017, the federal government launched an initiative to distribute 20,000 solar powered lighting systems to rural communities. Additionally, the government plans to add 13 GW of off-grid solar power by 2030. On a state level, through the Lagos Solar project, a joint investment of Lagos State Electricity Board (LSEB) and the UK Department for International Development (DFID), the Lagos state government installed nearly 5 MWp of solar generated off-grid power for 172 schools and 11 clinics within Lagos State. An additional 1.5 MWp is being installed at public health clinics in Kaduna State under the Solar Nigeria programme by DFID. Several other off-grid schemes with support from international partners are gaining traction across the country.

Table 2 Overview of the main stakeholders in the energy sector in Nigeria

Institution	Role
The Presidency of the Federal Republic of Nigeria Presidential Action Committee on Power (PACP)	The Presidency created an ad-hoc body under its direct control responsible for steering progress in the context of the Power Sector Reform. It gives guidance to the Presidential Task Force on Power (PTFP), which is the operational body.
National Planning Commission (NPC)	The National Planning Commission (NPC), together with all the relevant actors, developed Vision 2020 for the energy sector which led to the sector's reform agenda. The Commission also works very closely with the Presidential Task Force on Power (PTFP).
Federal Ministry of Power (FMP)	Formerly the Federal Ministry of Power and Steel, it is in charge of policy formulation and coordination in the power sector, including on renewable energies and energy efficiency.
Nigerian Electricity Regulatory Commission (NERC)	Its mandate is to monitor and regulate the power sector and ensure compliance with market rules and operating guidelines, mainly for interconnected generation, transmission and distribution, but also off-grid and self-generation requiring licensing.
Rural Electrification Agency (REA)	Mandated with the overall responsibility of supporting rural electrification, mainly with the mobilisation of capital for rural electrification projects.
Nigeria Bulk Electricity Trader (NBET)	It is responsible for purchasing electricity from generation companies under long term Power Purchase Agreements (PPAs) and selling it to electricity distribution companies (DISCOs).
Transmission Company of Nigeria (TCN)	A state entity responsible for the transmission of electricity from power plants to distribution companies, eligible customers and for export.
Niger Delta Power Holding Company Limited (NDPHC)	It serves as an administering institution for the contracts, management and operation of the assets developed under the National Integrated Power Projects Programme (NIPP).
Energy Commission of Nigeria (ECN)	Serves as a strategic planning and coordination body of national energy policies and master plans.

Small hydropower

Small hydropower (SHP) according to the definition in the National Renewable Energy and Energy Efficiency Policy (NREEEP) is defined as 1 to 30 MW in Nigeria. As of 2017, the SHP installed capacity was 64.2 MW. Total estimated theoretical SHP potential was 3,500 MW, indicating that only 2% has been developed. Based on data compiled from the planned and studied sites, Nigeria has an economic SHP potential of 735 MW (9% has been developed).

Through the Energy Commission of Nigeria (ECN) and ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE), the United Nations Industrial Development Organization (UNIDO) has been at the forefront of facilitating the transfer of technology in manufacturing micro-hydropower turbines and creating awareness among the relevant stakeholders of the huge SHP potentials available in the country. This has led to the identification of over 200 potential SHP sites, 17 feasibility studies with detailed project reports carried out and the development of three sites that are under construction. Although 17 sites have bankable documents, private investors are hesitant to develop them as the initial investment costs are high and obtaining finance is difficult. In the 5th Global Environment Facility (GEF-5) project cycle, 3.1 MW of the cumulative capacity have been planned for direct implementation and to be replicated by private investors, to an estimated capacity of over 30 MW.

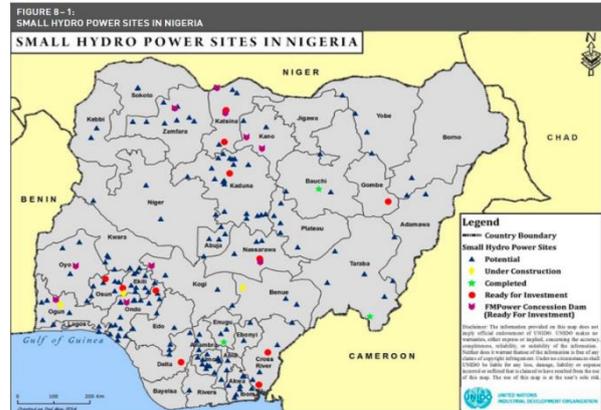


Figure 4 Nigeria Hydropower Atlas. Source: United Nation Industrial Development Organisation (UNIDO), 2013

The Renewable Energy Master Plan launched in 2005 aims to increase the contribution of RE to account for 10% of Nigerian total energy consumption by 2025. The initial targets of the policy based on peak supply from SHP were 40 MW by 2007, 100 MW by 2008, and 400 MW by 2016. These targets assumed that the 200 identified potential SHP sites would be developed. However, achieving these targets has been a difficult task.



Figure 5 Solar resource Nigeria (2019) The World Bank, Source: Global Solar Atlas 2.0, Solar resource data: Solargis)

The EPSRA allows a person to construct, own or operate an off-grid power plant not exceeding 1 MW in aggregate at a site without a license. This exemption to holding a license favours energy generation through SHP since some of the identified SHP sites fall within the required range. It is also expected to encourage the private sector to invest in small, mini and micro hydropower, especially for rural development and off-grid generation.

Solar energy

Nigeria has significant solar energy potential, with distributed solar radiation averaging 19.8 MJm²/day and average sunshine hours of 6h/day. The total assumed potential for concentrated solar power and photovoltaic generation is around 427,000 MW. The best potential for solar power lies in the northern region of the country, where the average GHI values range between 2,000 and

2,200 kWh/m². This is comparable to other high-yielding sites around the world, such as Southern Spain and Australia. Solar PV plants in Nigeria produce power at a comparable levelised cost of energy when compared to petrol and diesel generators. In July 2016, 14 greenfield independent PV projects with a capacity of 1,125 MW had their PPAs signed by the Nigerian Bulk Electricity Trading Plc (NBET). The government is planning on increasing mini-grid capacity from approximately 50 MWh in 2016 to 5,314 MWh in 2030 as part of the Electricity Vision 2030. It is expected that this will mostly be comprised of solar energy. The government is aiming to achieve a 20% contribution of solar energy (PV and solar thermal) to the national electricity generation mix by 2030.

Biomass energy

Biomass remains the most dominant energy for both the household sector and small-scale rural industries and commercial outlets in Nigeria; over the years its use continues to increase. In Nigeria, about 95% of the biomass is used to meet off-grid heating, cooking needs and cottage industrial needs. These include processing cassava, oil seeds, local bakeries, blacksmiths, brewing and other activities that are closely related to the household, and small scale commercial activities, such as restaurants, in both rural and urban areas. Similarly, some households in the urban areas have also long been dependent on biomass from rural areas for some of their domestic fuel needs.

Biomass resources available in the country include fuelwood, charcoal, agricultural waste and crop residue, sawdust and wood shavings, animal dung/poultry droppings, and industrial effluents/municipal solid waste. However, fuelwood and charcoal constitute the bulk of the biomass energy consumption, particularly in the residential sector.

Biomass consumption in Nigeria has been increasing unprecedentedly; it increased by about 300% from 32,754 ktoe in 1971 to 93,820 ktoe in 2011. This trend shows that more Nigerians are either stagnating or descending on the energy ladder, despite growth in incomes. Empirical evidence from other developing countries including some African countries, such as South Africa suggest that with increasing income people generally move up towards the top of the energy ladder from firewood to charcoal or kerosene and then to liquefied petroleum gas (LPG), natural gas, or electricity for cooking.

Wind energy

Ministry of Science and Technology Nigeria has a low to moderate potential for wind power with only a few selected areas reaching speeds sufficient for electricity generation. Based on the wind energy resource mapping carried out by the Ministry of Science and Technology (MST), the majority of the country has annual average wind speeds of between 2.0 m/s - 4.0 m/s at 80m above the ground. These speeds are best suited for water pumping rather than electricity generation. In the most suitable locations, wind speeds of up to 5 m/s were recorded, which may have electricity generating potential. Only in the northmost of the country do speeds exceed 7 m/s. The MST study also indicated fair wind speeds, sufficient for energy generation by wind farms, in Maiduguri, Lagos, Enugu, the western shoreline and the Mambila Plateau. A 10 MW wind farm located in the north of Nigeria in Katsina, is expected to be completed in the second quarter of 2020. It will be the first wind farm in Nigeria. A 100 MW wind farm in the Plateau State, developed by JBS Wind Power Limited, is in the process of obtaining environmental authorisation and has received a provisional Independent Power Producer license from NERC. Government aims to achieve and

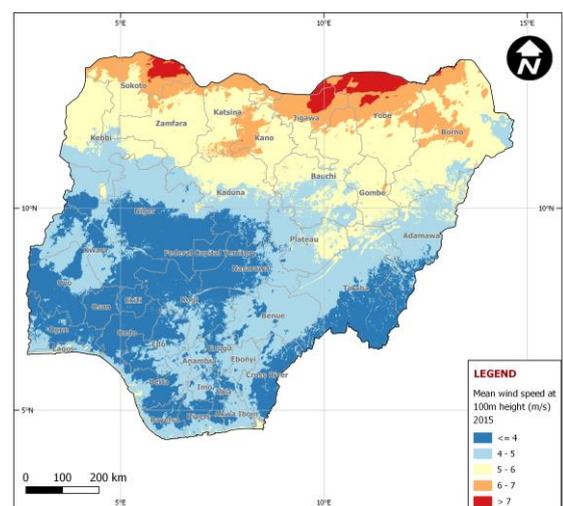


Figure 6: Mean wind speed at 100m height (m/s). Source: SE4All Africa Hub and African Development Bank, 2015

maintain a 2% wind energy contribution to the national electricity generation mix by 2020 until 2030.

Geothermal

Geothermal exploration is still ongoing and not fully exploited in Nigeria. Based on the available information extracted from the geology and mineral maps of Nigeria, three major potential geothermal sources are available. These are: the Biu Plateau, Pindiga Formation of the Benue trough and the Gombe sandstones (containing the Wikki springs). The Biu plateau has volcanic points representing a shallow depth to the mantle. This can provide an enormous amount of energy for generation of electricity while the other point (Wikki warm springs) can provide enormous amounts of water for heating and other domestic purposes.

Natural gas

Nigeria is one of the top ten nations in the world for natural gas, with huge natural gas reserves. As of April 2019, production is estimated at 1.2 billion standard cubic feet of gas per day. The combined total of proven reserves is 200trn ft³ with a further 600trn ft³ of estimated unproven reserves, according to the Nigerian National Petroleum Corporation (NNPC).

The current gas supply is enough to support about 5 GW of power generating capacity. Nigeria's gas reserves are about three times the value of her crude oil reserves. The largest natural gas initiative in Nigeria is the Nigerian Liquefied Natural Gas project, which is operated by several foreign oil companies and the NNPC. Another major natural gas project is the West African Gas Pipeline, which has encountered several bottlenecks. However, when completed the pipeline would transport natural gas from Nigeria to Ghana, Togo, Benin Republic and Cote d'Ivoire. The bulk of the associated gas is flared off and Nigeria loses an estimated \$18.2 million daily from the loss of revenue from flared gas. In recent years, the volume of gas flared has been significantly reduced and plans have been initiated to put an end to gas flaring in the coming years.

Previous focus on producing natural gas mainly for export (LNG) is gradually being replaced with one that also accommodates gas production for domestic use (i.e. for cooking and for the power generation and manufacturing sectors).

The president also established the Nigerian Gas Flare Commercialisation Programme in 2016 to encourage the use of natural gas, and set a target date of 2020 for the elimination of flared gas – though it looks unlikely that this target will be met.

The main constraint is distribution to households and industrial plants, which is hampered by a lack of investment in power and gas distribution infrastructure, in part due to market uncertainties such as those resulting from the botched privatisation of the electricity sector in 2013. Investment is also being constrained by the lingering impact of the deep economic recession of 2016-17 and customers' inability to pay gas suppliers and power companies out of pocket.

Mini grid sector development

Nigeria is one of the largest and most attractive markets for off grid energy in Sub-Saharan Africa. This is due to the federal government's ambitious electrification plans backed by policies to attract more investment in the off-grid space.

The government's SEforAll goal is to increase access to reliable electricity to 90% by 2030 and increase the share of renewable energy to at least 10% by 2025. To achieve this, the government would need to connect over one million households a year. It therefore recognises the need to develop both on-grid and off-grid electrification projects simultaneously. As at 2017, there were 11 privately owned and operated mini grids serving about 10,000 people.

Over the past few years, the government has taken major steps to promote more investments by the private sector in the mini grid space. One of them is the creation of a mini grid specific regulatory framework in 2016 which favours developers. Some of the features in the framework include:

- Ability for mini grids to set cost-reflective tariffs using The Nigeria Electricity Regulatory Commission's (NERC) mini grid tariff tool
- Provisions for the arrival of the main grid
- Streamlined licensing and permit processes and requirements depending on the mini grid size, ownership model, and operational model
- Standard technical grid code requirements to facilitate future integration with the distribution network

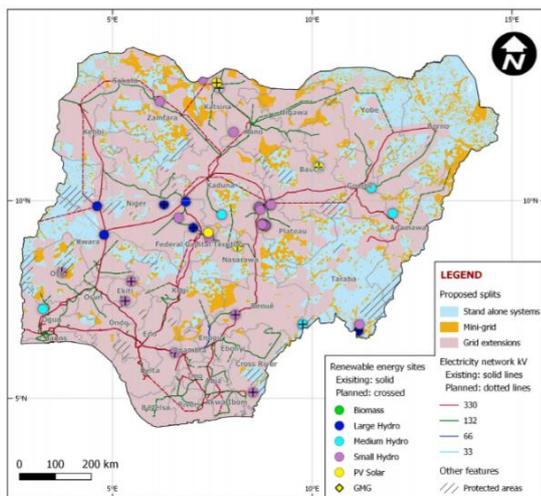


Figure 7: Potential sites for grid connection, mini grids and standalone solar systems. Source: SE4All Africa Hub and African Development Bank, 2018

Other incentives for private sector involvement include:

- A tax holiday of up to five years for renewable energy projects
- Exemption from import duty for solar panels
- Full foreign ownership of electricity projects

In addition to these policies and incentives, the Rural Electrification Agency (REA) works to reduce development costs for private companies by supporting on pre-development activities such as site identification and public sector facilitation. Currently, an estimated 8,000 sites have been identified to be suitable for mini grid development in Nigeria. REA manages an online portal to track the development of these 8,000 sites. The agency has also set buffer zones for distribution companies (DisCos) to prevent overlap with off-grid mini grids likely to build close to the grid.

REA also manages a Rural Electrification Fund (REF) that provides capital subsidies to approved public and private rural electrification projects, including solar home systems (up to \$300,000 or 75% of CAPEX per project for mini grids, and 50% of CAPEX for solar home systems).

Some mini grid companies operating in Nigeria include:

- ACOB Lighting Technologies
- Darway Coast
- GVE Projects Ltd
- Havenhill Synergy
- ICIMI
- Nayo Tropical Technology Ltd.
- Rubitec Solar
- Ventura Logistic Services Ltd.

Table 3: Active off grid programmes

Programme	Main activities
The Nigeria Electrification Project (NEP)	<p>\$150 million dedicated to solar hybrid mini grids. The aim is to develop 1,200 mini grids by the end of the programme. REA is providing subsidies to mini grid developers in two main ways:</p> <ul style="list-style-type: none"> • Kickstart subsidies to developers that win bids to develop in 200 pre-selected sites, aimed at attracting private companies into the mini grid space. Subsidies partially cover the cost of delivering electricity on a commercial basis • Expansion subsidies to provide pre-set performance based grants to an estimated 1,000 operating mini grids based on installed capacity, new connections, or a combination of both <p>Subsidies are distributed through the Rural Electrification Fund.</p>
Nigeria Energy Support Programme	Advisory services to the federal government on energy policy and management, as well as other stakeholders on data management, environmentally friendly power supply, and enabling environment for renewable energy and energy efficiency investment.
The Africa Energy Program	<p>Implemented by Rocky Mountain Institute (RMI). RMI works with various stakeholders in the public and private sector to develop affordable, resilient and efficient distributed energy systems. Currently facilitating development of mini grids in under-grid areas.</p>
Scaling Off-Grid Energy (SOGE)	<p>Founded by USAID, DFID and the Shell Foundation. Project aims to facilitate technology innovation, fund early stage companies, and support other areas of off grid energy development so as to accelerate development of off grid energy in sub-Saharan Africa.</p>
Regional Off-Grid Electrification Project (ROGEP)	<p>A \$200 million project funded by the World Bank and managed by ECREEE. Targeting 15 countries in the ECOWAS region and four countries in the Sahel region, with a focus on mobilising private sector investment in the off-grid electrification space. The project has three main components:</p> <ul style="list-style-type: none"> • Technical assistance to public and private sector • Access to finance for off-grid energy projects through local financial institutions • Support to electrify public institutions
AECF/REACT Household Solar programme	<p>Funding support for SHS companies, mini grid companies, clean cookstove companies, innovative distribution models for off-grid energy, and innovative ideas to stimulate “next generation” approaches to renewable energy. Support is in the form of interest free loans, non-repayable grants, and technical assistance. Roll out to Nigeria companies done in for Round 2 call started in 2019.</p>
Energizing Economies Programme	<p>Implemented by REA. Aims to improve energy access in areas that have high economic impact potential for the country. Selected clusters have heavy electricity-reliant commercial activity. The programme has identified 340 economic clusters with total estimated demand of at least 3 GW across the country.</p>

Industry associations

Association of Nigerian Electricity Distributors (ANED)

ANED is an association of the 11 electricity distribution companies (DisCos) in Nigeria. It is dedicated to advocacy for the Nigerian electricity supply industry, facilitating the setting of industry standards, promoting the collective interests of the DisCos and carrying out community sensitisation and stakeholder consultation on behalf of the DisCos.

Renewable Energy Association of Nigeria (REAN)

REAN is an independent, non-profit industry association, whose mission is “to be the umbrella association for all Renewable Energy promoters enabling and encouraging the sustainable development of the Nigerian economy through Renewable Energy”.

Solar Energy Society of Nigeria (SESN)

SESN’s objectives are to provide a medium for national and international dissemination of Solar Energy, cooperation among scientists, engineers and technologists working in the field of energy, and a focal point for publication.

References and further reading

Nigeria economic recovery and growth plan (2017 - 2020)

<https://yourbudget.com/wp-content/uploads/2017/03/Economic-Recovery-Growth-Plan-2017-2020.pdf>

Nigeria Energizing Economies programme overview

https://www.esmap.org/sites/default/files/Presentations/Energizing%20Economies_Uche.pdf

Nigeria national renewable energy action plans (2015-2030)

[http://www.power.gov.ng/Press%20Release/NATIONAL%20RENEWABLE%20ENERGY%20ACTION%20PLANS%20\(NREAP\).pdf](http://www.power.gov.ng/Press%20Release/NATIONAL%20RENEWABLE%20ENERGY%20ACTION%20PLANS%20(NREAP).pdf)

ESMAP: Upscaling mini grids for low-cost & timely access to electricity

<https://esmap.org/sites/default/files/event-article/Nigeria%20Mini%20Grids%20Event%20Booklet9.pdf>

Doing Business

<https://www.doingbusiness.org/content/dam/doingBusiness/country/n/nigeria/NGA.pdf>

Official UK Government travel advice for Nigeria

<https://www.gov.uk/foreign-travel-advice/nigeria>

Useful contacts

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