

Figure 1: Energy profile of Nigeria



Energy Consumption and Production

In 2013, Nigeria had a population of 174 million (Table 1). In 2015, total electricity produced was 6,738 ktoe, of which 91.5 per cent came from fossil fuels and 8.3 per cent from hydro sources. Final electricity consumed was 2,218 ktoe (AFREC, 2015) as shown in Table 2. Figures 2 and 3 highlight the key energy statistics.

Table 1: Nigeria's key indicators

Key indicators	Amount
Population (million)	174
GDP (billion 2005 USD)	183.31
CO ₂ emission (Mt of CO ₂)	61.00

Source: (World Bank, 2015)

Energy Resources

Biomass

Worldwide, Nigeria is the third largest producer of bioenergy, after China and India, respectively. In 2010, the share of bioenergy of total primary energy supply was over 80 per cent (WEC, 2013). In 2011, Nigeria was among the largest woodfuel producers, along with India, China, Brazil and Ethiopia.

Oil and natural gas

Nigeria's proven recoverable reserves at the end of 2011 was 37,200 million barrels while oil production at the end of the same period was 881,066 thousand barrels (WEC, 2013). It has oil reserves of about 35 billion barrels ($5.6 \times 10^9 \text{ m}^3$) and gas reserves of about 5 trillion cubic metres, ranking it 10th and 9th in the world, respectively.

Nigeria has the second largest proven oil reserves in Africa, after those of Libya. The oil fields are located in the south, specifically in the Niger delta and offshore in the Gulf of Guinea. Current exploration activities are mostly focused in the deep and ultra-deep offshore, with some activities in the Chad basin, located in the northeast of the country. Nigeria has been a member of OPEC since 1971. Most of the oil is exported to North America and Western Europe and the bulk of the refined product requirements are imported.

Security is an issue in this sector and is curtailing oil exploration projects. For instance, in 2011, only three exploratory wells were drilled compared with more than 20 in 2005. This has affected the government's expected ability to increase proven oil reserves to 40 billion barrels over the next few years.

Nigeria (and Algeria) are the main gas producers in Africa and production is expected to double between now and 2030, increasing to about 400 bcm per annum. Proved recoverable reserves of natural gas in Nigeria at the end of 2011 were 5,110 bcm; current production, at 29 bcm, is estimated to last more than 100 years (WEC, 2013). Gas in Nigeria is supplied to industrial users in and around Lagos. The Escravos pipeline is the main conduit through which gas originating in the Niger Delta passes as it is supplied to a variety of industrial users in and around the Lagos region. Other major industrial clients use this gas in captive power plants, such as Guinness's Ogba and Benin breweries.

Nigeria had an estimated 180 trillion cubic feet (Tcf) of proved natural gas reserves at the end of 2011, according to the OGJ, making Nigeria's the world's ninth largest natural gas reserve.

Figure 2: Total energy production, (ktoe)

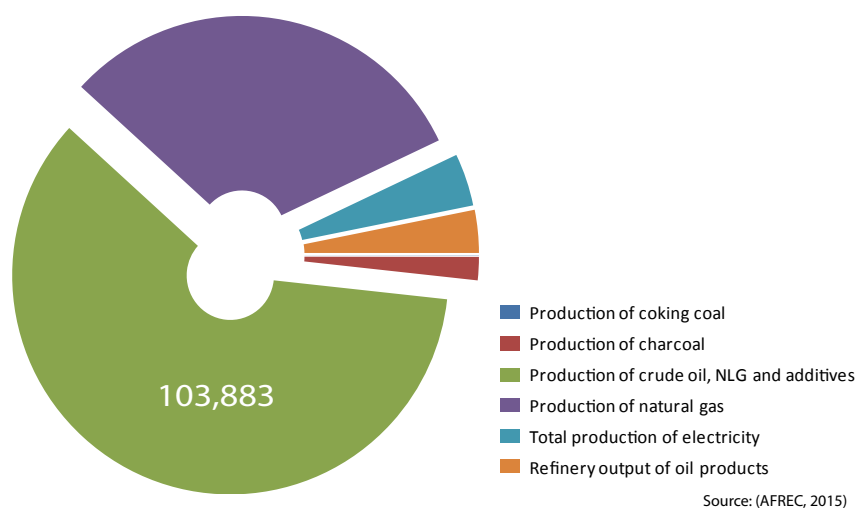


Figure 3: Total energy consumption, (ktoe)

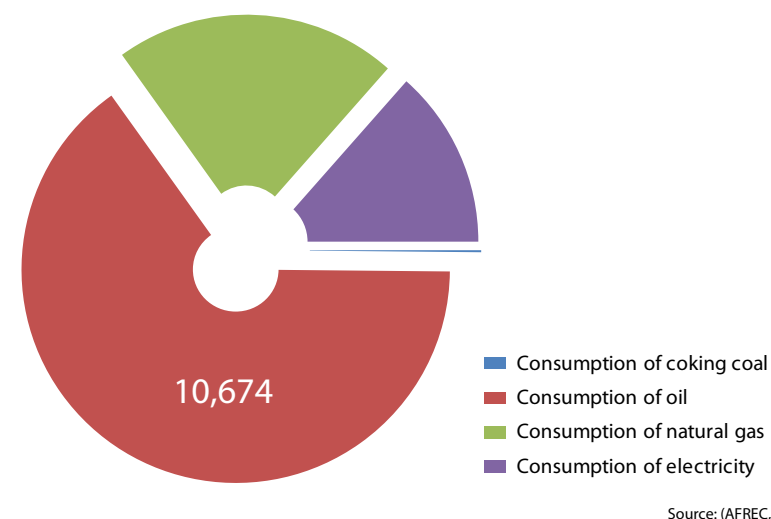


Table 2: Total energy statistics (ktoe)

Category	2000	2005	2010	2015 P
Production of coking coal	2	5	19	25
Production of charcoal	896	1,559	2,228	2,975
Production of crude oil, NLG and additives	107,708	120,930	121,377	103,883
Production of natural gas	11,733	19,963	29,863	53,830
Production of electricity from biofuels and waste	0	0	0	0
Production of electricity from fossil fuels	782	1,340	1,698	6,169
Production of nuclear electricity	-	-	-	-
Production of hydro electricity	484	684	543	562
Production of geothermal electricity	-	-	-	-
Production of electricity from solar, wind, Etc.	0	0	0	8
Total production of electricity	1,266	2,024	2,240	6,738
Refinery output of oil products	4,668	9,020	5,083	5,496
Final Consumption of coking coal	31	4	19	25
Final consumption of oil	9,849	11,147	11,387	10,674
Final consumption of natural gas	1,077	3,126	1,346	3,512
Final consumption of electricity	783	1,539	1,859	2,218
Consumption of oil in industry	705	551	341	424
Consumption of natural gas in industry	1,117	1,452	1,346	3,502
Consumption of electricity in industry	164	192	298	366
Consumption of coking coal in industry	7	4	19	25
Consumption of oil in transport	7,198	8,809	886	8,555
Consumption of electricity in transport	-	-	-	-
Net imports of coking coal	0	0	0	0
Net imports of crude oil, NGL, Etc.	-103,151	-111,422	-109,292	-104,343
Net imports of oil product	6,885	4,424	8,312	7,766
Net imports of natural gas	-5,094	-11,337	19,728	-22,771
Net imports of electricity	-2	0	0	0

- : Data not applicable

0 : Data not available

(P): Projected

(AFREC, 2015)

Table 3: Nigeria's coal reserves and production (million tonnes)

Country	Coal reserves	Production
Nigeria	190	
Rest of region	357	2
Africa total	31,617	255.4

Source: (GWEC, Various years)

Coal

By the end of 2011, Nigeria had 21 million tonnes of proved recoverable bituminous coal reserves, including anthracite (Table 3) (WEC, 2013). It is among the top 5 countries in Africa, by reserves. The others are South Africa, Zimbabwe, Mozambique and Tanzania.

Wind

Wind is not a major source of energy in Nigeria. In 2011, Nigeria had only 2 MW of installed capacity (WEC, 2013).

Nuclear

Nigeria plans to have about 1,000 MWe of nuclear power installed by 2017 and 4,000 MWe by 2027. In 2009, cooperation agreements were signed with Russia on the peaceful use of nuclear energy, including the construction of nuclear power plants (WEC, 2013). Two sites have been proposed to host 4,000 MW nuclear power projects: Gereggu in Kogi State and Itu in Akwa Ibom State (ECN,

2012). The Nigerian Atomic Energy Commission (NAEC) is to conduct standard surveys, including Environmental Impact Assessments (EIA), detailed evaluations and characterization. In addition, the government will enact a comprehensive nuclear law, create an independent nuclear power regulatory body with clear authority and functions separated from promotional bodies and functions and ensure waste and fuel-cycle management. A draft strategy for the safe and sustainable management of radioactive waste and spent nuclear fuel has also been prepared. It includes an option for use when repatriation of spent fuel is not possible (ECN, 2012).

Geothermal

The literature indicates that more studies are necessary, but current indications point to the potential for geothermal energy (Zira, 2013). The normal geothermal gradient of the earth is between 2-30c/100m and a geothermal gradient above this range is considered to be a good site for geothermal systems. According to research findings, the geothermal gradient in the Niger Delta ranges from 1.3 to 5.50c/100m. The geothermal gradient of the Anambra Basin ranges from 2.5 to 4.90c /100m (Avbovbo, 1978 in (Zira, 2013)). A similar study of the geothermal gradient

of the Bida Basin shows that it ranges from 2 to 2.50c/100m. The Borno Basin temperature gradient ranges from 1.1 to 5.90c/100m. Finally, a study on the Sokoto Basin has revealed that its geothermal gradient ranges from 0.9 to 7.60c/100m (Ewa and Schoeneich, 2010 in (Zira, 2013)). Areas of geothermal anomalies with gradients above 5°C/100m are likely to be potential areas for prospecting. There are also hot and warm springs, which occur in Akiri in Benue State, Wikki in Yankari Game Reserve in Bauchi State and Ruwan Zafi in Adamawa State located in Lamurde, for example.

Solar

Nigeria is in the process of engaging with the private sector to set up renewable energy projects, especially in the field of solar energy. For example, discussions are taking place to set up a total of 1 GW solar power capacity across the country. Nigeria has signed agreements with three companies: Solius NGPC, Peoples Home Association and Solar Force Nigeria Limited. They will include large utility-scale power projects and distributed power projects. Nigeria is estimated to have 20 MW of solar energy installed (REN21, 2014).

Tracking progress towards sustainable energy for all (SE4All)

Some 75 million people in Nigeria, mostly in rural areas, have no access to electricity (Table 4 and Figure 4). By 2012, 34.4 per cent of the rural population had access to electricity, compared with 83.6 per cent in urban areas. Only a quarter of the population (24.85 per cent) or about 127 million people have access to modern fuels and there are disparities between rural and urban access: only 11 per cent in rural areas and 55 per cent in urban areas (World Bank, 2016); (World Bank, 2015).

The Nigerian economy energy intensity (the ratio of the quantity of energy consumption per unit of economic output) was 6.3 MJ per US dollar (2005 dollars at PPP) in 2012, down from 9.6 MJ per US dollar in 1990. The compound annual growth rate (CAGR) between 2010 and 2012 was 0.95 (World Bank, 2015).

The share of renewable energy in the total final energy consumption (TFEC) has been almost constant since the 1990s at around 88 per cent. Traditional solid biofuels form the biggest share of renewable sources at 77.1 per cent of TFEC in 2012, while the modern solid biofuels contributed 9 per cent and hydro only 0.4 per cent. Renewable sources contributed a 19.7 per cent share of electricity generation in 2012.

Intended Nationally Determined Contributions (INDC) within the framework of the Paris climate Agreement

Nigeria's Intended Nationally Determined Contributions (INDCs) aim to ensure economic and social development by growing the economy at 5 per cent a year, improving the standard of living and ensuring access to electricity for all (FRON, 2015). Table 5 shows the energy-related INDCs.

Table 4: Nigeria's progress towards achieving SDG7 – Ensure access to affordable, reliable, sustainable and modern energy for all

Target	Indicators	Year					
		1990	2000	2010	2012	2000-2010	2011-2015
7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 per cent of population with access to electricity	42	45	48	55.6		
	7.1.2 per cent of population with primary reliance on non-solid fuels	23	26	25	25		
7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share in the total final energy consumption	88.4	86.9	88.8	88.5		
7.3 By 2030, Double the rate of improvement of energy efficiency	7.3.1 GDP per unit of energy use (constant 2011 PPP \$ per kg of oil equivalent)			7.1	7.2 (2011)		
	Level of primary energy intensity(MJ/\$2005 PPP)	9.6		6.2	6.3	6.20	6.27

Sources: (World Bank, 2015); (World Bank, 2016)

Figure 4: SDG indicators





Percentage of population with access to electricity	Access to non-solid fuel (% of population)	GDP per unit of energy use (PPP \$ per kg of oil equivalent) 2013	Renewable energy consumption (% of total final energy consumption), 2006-2011, 2012
55.6%	24.85%	7.28	86.47%
			

Table 5: Nigeria's key aspects/key mitigation measures to meet its energy Intended Nationally Determined Contributions (INDCs)

INDC
* Work towards ending gas flaring by 2030.
* Work towards off - grid solar PV of 13GW (13,000 MW) .
* Promote the use of efficient gas generators.
* Increase energy efficiency by 2 per cent per year (30 per cent by 2030).
* Promote transport shift from private cars to public buses.
* Improve and modernize electricity grid.
*Implement economy-wide energy efficiency.
*Build efficient gas power stations.
*Work toward ending of gas flaring.
*Adopt and disseminate a climate smart agriculture.
*Reduce transmission losses.
*Promote use of renewable energy.
*Improve energy efficiency by 20 percent, generate 13 GW of renewable electricity provided to rural communities currently off-grid, and end gas flaring.

Source: (MEM, 2015)

Table 6: Nigeria's institutional and legal framework

Basic Elements	Response
Presence of an Enabling Institutional Framework for sustainable energy development and services (Max 5 institutions) most critical ones	<ul style="list-style-type: none"> • Federal Ministry of Power (FMOP) • Department of Petroleum Resources within the Ministry of Petroleum Resources. • Energy Commission of Nigeria (ECN) was established in 1989 • Rural Electrification Agency (REA) established by the EPSR Act (2005) • Presidential Taskforce on Power (PTFP) established in 2010 • Nigerian Nuclear Regulatory Authority (NNRA), 1995
Presence of a Functional Energy Regulator	Nigerian Electricity Regulatory Commission (NERC), 2005
Ownership of sectoral resources and markets (Electricity/power market; liquid fuels and gas market)	Nigerian National Petroleum Corporation (NNPC), 1977, is an integrated Oil and Gas company
Level of participation in regional energy infrastructure (Power Pools) and institutional arrangements	West African Power Pool (WAPP)
Environment for Private Sector Participation	
Whether the Power Utility(ies) is/are vertically integrated or there is unbundling (list the Companies)	<p>Unbundled – 17 unbundled business units under the Power Holding Company of Nigeria (PHCN):</p> <ul style="list-style-type: none"> • Distribution (11 companies): Abuja Electricity Distribution Company plc, Benin Electricity Distribution Company plc, Eko Electricity Distribution Company plc, Enugu Electricity Distribution Company plc, Ibadan Electricity Distribution Company plc, Ikeja Electricity Distribution Company plc, Jos Electricity Distribution Company plc, Kano Electricity Distribution Company plc, Kaduna Electricity Distribution Company plc, Port Harcourt Electricity Distribution Company plc, and Yola Electricity Distribution Company plc • Generation (6 companies): Afam Power plc, Egbin Power plc, Kainji Hydro-Electric plc, Sapele Power plc, Shiroro Hydro-Electric plc, and Ughelli Power plc • Transmission (1 company): Transmission Company of Nigeria
Where oil and gas production exists, whether upstream services and operations are privatized or state-owned, or a mixture (extent) e.g., licensed private exploration and development companies)	
Extent to which Downstream services and operations are privatized or state-owned, or a mixture (extent)	
Presence of Functional (Feed in Tariffs) FIT systems	
Presence Functional IPPs and their contribution	Three large-scale IPPs produce approximately 25 per cent of Nigeria's electric power
Legal, Policy and Strategy Frameworks	
Current enabling policies (including: RE; EE; private sector participation; & PPPs facilitation) (list 5 max) most critical ones	<ul style="list-style-type: none"> • National Electric Power Policy (NEPP), 2001 • National Integrated Power Project (NIPP) – established in 2004 • Energizing Access to Sustainable Energy (EASE) • Roadmap for Power Sector Reform (RPSR), 2013
Current enabling laws/pieces of legislation (including: RE; EE; private sector participation; & PPPs facilitation) – including electricity/grid codes & oil codes (5 max or yes/no) most critical ones	<ul style="list-style-type: none"> • Electric Power Sector Reform Act (EPSR), 2005 (Act No. 6 of 2005) • Energy Commission of Nigeria Act (Cap 109 LFN of 1990) • Nuclear Safety and Radiation Protection Act (1995) • Electricity Industry (Enforcement) Regulations (2014) • Draft Regulations for Investment in Electricity Networks in Nigeria (2014)

This table was compiled with material from (REEEP, 2014) and (Usman & Abbasoglu, 2014)

Institutional and Legal Framework

The Federal Ministry of Power (FMOP) is in charge of the energy sector. The energy regulator is the Nigerian Electricity Regulatory Commission (NERC) set up in 2005. Under the Power Holding Company of Nigeria (PHCN) there are 11 distribution, 6 generation and 1 transmission

companies. They manage the electricity supply in each state or region of the country. At a regional level, the country is a member of the West African Power Pool. The legal framework is provided by the Electric Power Sector Reform Act (EPSR), 2005 (Act No. 6 of 2005). The main sector policy is the National Electric Power Policy (NEPP), 2001 (Table 6).