THE INTERNATIONAL REC STANDARD

Country Assessment Report

Country/Region Name- Nigeria:

Nigeria is situated in West Africa along the Gulf of Guinea; bordered by Niger, Chad and Cameroon and Benin. It is one of the world's largest 25 economies and widely regarded as a potential economic powerhouse in Africa. Its population of 195 million; the largest in Africa, with most inhabitants concentrated in the south. Its GDP is just under $400 billion, making it the richest economy on the continent. Its growth rate is around 2%.

(World Bank 2018)

Economic structure and activity:

Nigeria has a mixed-economic system, balancing centralised economic planning and some market freedom. The service sector accounts for 38.12% of the Nigeria's GDP, with rising growth in financial, banking, telecommunications and tourist services. Nigeria's economic growth is predominantly centred around its abundant oil and natural gas reserves, possessing the largest fossil fuels reserves on the continent. The country has an abundance in other natural resource commodities, extracting tin ore, coal, iron ore, limestone, niobium, lead, zinc and arable land. Industry is the smallest contributor to Nigeria's GDP (15.49%) whilst agriculture accounts for a significant proportion of the nation's GDP (38.12%). Its major crops include yam, rice, maize, sesame, cashew nuts, cocoa beans, rubber and bananas. Subsistence farming still dominates the agricultural sector.

(Statista 2018; Santander 2020; World Bank 2020)

Top private companies with RE commitments:

Generation and demand: (e.g. type, MW, TWh)

Category	STATIONS	Type	NO OF INSTALLED GENERATOR UNITS	INSTALLED CAPACITY (MW)	UNITS IN OPERATION	EFFECTIVE CAPACITY (MW)
Concession	KAINJI	HYDRO	8	880	4	440
	JEBBA (run of river)	HYDRO	6	680	5	475
	SHIRORO	HYDRO	4	600	4	600
Privatised	EGBIN	STEAM	5	1100	3	660
	SAPELE	STEAM	6	720	1	50
	DELTA	OCGT	18	915	11	555
	AFAM IV & V	OCGT	8	300	1	75
	GEREGU	OCGT	3	435	3	435
	OMOTOSHO	OCGT	8	336	8	336
	OLORUNSOGO	OCGT	8	336	8	336
NIPP	GEREGU NIPP	OCGT	3	435	1	145
	SAPELE NIPP	OCGT	4	500	2	225
	ALAOJI NIPP	OCGT	4	504	2	250
	OLORUNSOGO NIPP	OCGT	6	750	2	250
	OMOTOSHO NIPP	OCGT	4	500	3	375
	ODUKPANI NIPP	OCGT	5	625	4	480
	IHOVBOR NIPP	OCGT	4	450	3	337.5
	GBARAIN NIPP	OCGT	1	112.5	1	112.5
IPP	OKPAI	CCGT	3	480	3	320

	AZURA - EDO	CCGT	3	461	3	461
	AFAM VI	CCGT	4	650	4	650
	IBOM POWER	OCGT	3	198	1	115
	AES	OCGT	0	0	0	0
	ASCO	OCGT	2	0	0	0
	OMOKU	OCGT	6	150	4	100
	TRANS-AMADI	OCGT	4	100	3	66
	RIVERS	OCGT	1	180	1	180
Eligible Customers	EGBIN ST 6	STEAM	1	220	1	220
	PARAS ENERGY	OCGT	8	70	8	70
TOTAL			**140**	**12,688**	**94**	**8,319**

Table 1. Installed and effective capacity of electricity generators by type and location.

Note:
Installed capacity is overstated. For older power stations some units have not operated for years and need full replacement. For new power stations units are stated as installed while far from fully commissioned – indeed gas may not have been contracted. For available capacity we took two National Control Centre Daily Reports for 2018 about three months apart. We used the higher of the two values hence there is a potential overstatement even in that value.
Generation is currently limited by gas constraints (both in supply and transportation). Should the gas problems be solved it would then be limited by grid capacity. Nigeria currently has the best high voltage (330kV) grid in Africa outside South Africa, however transformation down to 132kV and beyond are problematic.

Demand is unknown and never fully met. Power outages are a daily occurrence. Annual generation is around 35TWh, of which less than 28TWh reaches consumers. Nigeria's power density is 33W per person, which is one of the lowest in Africa.

Electrical Interconnection and import/export:

Nigeria is a member of the West African Power Pool which extends across the whole of West African to Senegal including Mali and Niger. There are no connections further east into Cameroon or Chad. To the west there is physical connection through Benin and Togo to Ghana however, due to very poor Nigerian frequency control, in recent years this has largely been operated "open" with Nigeria just feeding islanded local load in Benin and Togo. Nigeria also feeds isolated local load in Niger to the north.

There are no imports. Exports are normally around 200MW.

Market Structure:

Nigeria privatized much of its electricity industry following the Electric Power Sector Reform Act of 2005. The market is now fully vertically decoupled: generators cannot own distribution networks and there is very limited distributor ownership of generation (essentially embedded only). All 6 generators and 11 distribution/suppliers are (conceptually) privately owned.
The Transmission Company of Nigeria (TCN) is federally owned and charges users for system operator, market operator and wires services. These Transmission Use of System Agreements are Active since signature in 2013. The Act envisages separation of the Independent System Operator (ISO) from the Transmission Service Provider (TSP) with the ISO remaining government owned and the TSP privatized/concessioned whole or in parts.

The Bulk Trader (Nigerian Bulk Electricity Trader – NBET) buys all generation under Power Purchase Agreements (PPAs) and sells it on to the 11 distributors under Vesting Contracts (VCs). Neither the PPAs or VCs are Active as NBET has not agreed that the conditions precedent (CPs) have been fulfilled.

Responsible Government Department: (include key contacts)

- **Vice-President's Office**

The Vice-President's Office (the VP takes overall responsibility for Electricity):
[redacted] (Special Advisor to the President on Power Privatisation) – was assistant to Maurice Smith at the Nigerian Infrastructure Advisory Facility (UK Government funded) from 2008 to 2016

- **Ministry of Power, Works and Housing**

[redacted] (Permanent Secretary Power) was advised by Maurice Smith on the Ministry's budget submission in 2016.
Maurice Smith was personal technical advisor to the Minister of Power 2009-10 and Technical Advisor to the Minister of State for Power 2010-13.

Federal Ministry of Environment plays a secondary role as it has no direct mandate in the power sector. However, it prepares policies for environmental impact assessment for developing projects and approves the environmental and social impact assessment repor

- **Nigerian Electricity Regulatory Commission**

[redacted], Head of Engineering – a friend of Maurice Smith having worked closely together on Grid Code amendments between 2010 and 2018
[redacted], Head of Tariffs – close acquaintance of Maurice Smith having worked closely on Market Rules amendments from 2010 to 2016
[redacted], Head of Legal – Maurice Smith drafted model PPAs and VCs for her in 2008/9

Maurice Smith was one of the advisors to the former President, [redacted], during his period of office.

Existing/Planned Energy Legislation: (is there a CPO)

2001 National Electric Power Policy (NEPP)
2005 Electric Power Sector Reform Act (EPSRA)
2015 Nigerian Renewable Energy and Energy Efficiency Policy (NREEEP)
2017 Power Sector Recovery Programme (PSRP) – *did not really get anywhere*

A fundamental characteristic of the Nigerian electricity market is the under-recovery of revenue from consumers. This means that insufficient funds flow back to generators making investment difficult. As a result, the majority of legislation and regulation is ineffective in delivering against very ambitious policy objectives.

There is no CPO although an RPS is considered within the NREEEP, however it may take years before the policy is implemented. Another aspect of NREEEP is international co-operation with an objective "*To*

enhance Nigeria's effective participation in international renewable energy and energy efficiency related organizations"

NERC has a target of 2000MW of renewables operating by 2020 and in 2015 established a feed-in tariff for solar, wind, biomass and small hydro.
The Federal Government also has a target of 30% renewable electricity by 2030.

Environmental Legislation for RE:

2016 Rural Electrification Policy and Implementation Plan (REPIP) – *generation is expected to be primarily renewable*
2017 Rural Electrification Fund Operational Guidelines (REFOG)

The implementation of legislation is at best a bit piecemeal. Rural Electrification legislation assumes PV solar and/or small hydro as off-grid or mini grid solutions.
Ministry/NERC agreed contract prices that NBET can apply in contracts with generators. The 2016 tranche of 14 PV Solar generation developers were given PPAs at US11.5¢/kWh. About half of them have transmission Grid Connection Agreements (GCAs). They are in the process of putting in place the Put-Call Option Agreements (PCOA – essentially government guarantees) which have pushed prices down. As of 2018; no PCOAs are in place and no projects have reached commissioning.

Existing/Planned Certificate Systems: (purpose, extent)

None – there are no REC schemes either presently operating in Nigeria or explicitly planned for the foreseeable future. However, as an international operating mechanism, there is an opportunity for I-REC to deliver a low-cost solution that could be adopted as part of a legislative solution.

RE market potential:

Nigeria's RE potential is estimated to be one and a half time greater than its existing fossil fuel reserves (Shaaban and Petinrin 2014). Table 2 highlights the scale of Nigeria's RE reserves. Hitherto, hydropower is the only RE to be exploited at commercial scale with three large hydro power stations which date from 1968 (Kainji), 1984 (Jebba) and 1990 (Shiroro). Their combined capacity is 1900 MW and account for 30% of Nigeria's installed generation capacity (see table 1). A 40MW hydro is nearing completion and the 700MW Zungeru hydro project (jointly developed with CNEEC – China) is due for completion in 2020

Nigeria's is ideally positioned for harnessing solar energy, receiving abundant and consistent exposure throughout most of the country, year-round. Its potential is most prominent in the north east with Maiduguri state reported to have the most potential (Mohammed et al. 2013). The country has set the target of installing 13 GW of solar by 2030. Fourteen 50-100MW PV Solar projects are planned, having been signed up in 2016.

Wind energy is less promising than solar but nation's most northern parts including Katsina, Kano, Kaduna, Gusau and Bauchi experience average wind speeds of up to 5 m/s and are worthy of investment (Mohammed et al. 2013).

Table 2. Nigeria's renewable energy potential.

(Elum and Mjimba 2020)

Table 2. Nigeria's renewable energy reserves/capacity as at December 2013.

Resource type	Reserves	Energy units (billion tonnes of oil equivalent, Btoe)
Hydropower (large scale)	11,250 MW	0.8 (over 40 yrs)
Hydropower (small scale, < 30MW)	3250 MW	0.32 (over 40 yrs)
Wave and tidal energy	150,000 TJ/(16.6 × 106 toe/year)	-
Biomass: Fuel wood	11 million hectares of forest and	-
Animal waste	woodland	-
Municipal waste	245 million assorted animals	-
	30 million tonnes/year	
Energy crops and agriculture residue	72 million hectares of agriculture land	-
Solar radiation	3.5–7.0 kW h/m^2/day	5.2
Wind	2–4 m/s (annual average) at 10 m in height	0.0003 (4 m/s@12% speed probability, 70 m height)

Source: (Energy Commission of Nigeria [ECN] 2014; Sambo 2009).

Market risks and challenges:

With significant oil and gas reserves, Nigerian generation is dominated by fossil fuels. However, chronic underinvestment and maintenance severely constrains operations. Electricity infrastructure is highly dilapidated and transmission lines were last upgraded in 1980. This means electrical power above 6000 MW is unable to be transmitted consistently. This is a challenge for many investors who are unsure how generated electricity will be evacuated to the grid for distribution but could be solved through embedded generation.

Distribution infrastructure is also dilapidated, with the projected cost to upgrade network regarded too cost. Power theft is another big challenge in Nigeria's energy sector.

(Edomah 2016; Elum and Mjimba 2020)

Extent of Engagement with Government: (brief summary of any contact already made with the national government regarding certification in general and I-REC)

None yet but see the existing relationships with Government and Regulator above.

Expected response from Government:

Low key but positive. There is an opportunity to 'sell' an infrastructure solution that brings in overseas funding without having to go through the existing bureaucratic systems.

Given the election in February 2019 (taking over in May) some form of positive statement from the VP with no cost or commitment (to him) may be possible.

Current Environmental Reporting in Energy:

Not much environmental reporting of energy consumption is done in Nigeria as most Nigerians use self-generation diesel units to supplement grid supplies.
Any other Relevant Information: With poor quality infrastructure and highly unreliable supply of power to consumers, the main focus of attention is on mini-grids. The distribution losses incentive mechanism in the sale contracts of the 11 distribution/supply companies should lead to a growth in smaller scale embedded generation. As yet, there is little to show against this mechanism.

Report Prepared by	I-REC Code Manager
Contributors	Maurice Smith prospective regional director
Preparation Date	December 2018

Code Manager Observation

Nigeria is perceived by the outside world as a "difficult" country. Its infrastructure is weak with power loss being a daily feature. However, Maurice Smith is a world-renown expert in power systems and their management. He was also involved in the early days of RECS in Europe and a former shareholder in Green Certificate Company. He is therefore one of very few who could open up West Africa for I-REC with the quality of approach required by the market. His excellent personal connections within the government and regulatory bodies represent a good probability of both delivering a good service in the region as well as passive facilitation by the authorities.