European Union

german cooperation
DEUTSCHE ZUSAMMENARBEIT

Nigerian Energy Support Programme (NESP)

The Nigerian Energy Sector

An Overview with a Special Emphasis on Renewable Energy, Energy Efficiency and Rural Electrification

2nd Edition, June 2015

Implemented by

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

Acknowledgements

This report on the Nigerian energy sector was compiled as part of the Nigerian Energy Support Programme (NESP). NESP is implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH and funded by the European Union and the German Federal Ministry for Economic Cooperation and Development (BMZ).

The authors would like to thank the GIZ Nigeria team for having entrusted this highly relevant subject to GOPA-International Energy Consultants GmbH, and for their extensive and dedicated inputs and guidance provided during implementation. The authors express their gratitude to all project partners who provided particularly valuable and interesting insights into ongoing activities during the course of the project. It was a real pleasure and a great help to exchange ideas and learn from highly experienced management and staff and committed representatives of this programme.

How to Read Citations

Bibliography is cited by [Author; Year]. Where no author could be identified, we used the name of the institution. The Bibliography is listed in Chapter 10.

Websites (internet links) are cited with a consecutive numbering system [1], [2], etc. The Websites are listed in Chapter 11.

Imprint

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

Nigerian Energy Support Programme (NESP)
2 Dr Clement Isong Street, Asokoro
Abuja / Nigeria
Contact: Daniel Werner (daniel.werner@giz.de)
Phone: + 234 8057601986

Federal Ministry of Power
Federal Secretariat Complex
Shehu Shagari Way, Maitama
Abuja / Nigeria
Contact: Engr. Faruk Yusuf Yabo (fyyabo@yahoo.com)

The first edition of this publication was funded by the German Federal Ministry for Economic Cooperation and Development (BMZ); the second edition is funded by BMZ and the European Union.

Authors / Editors etc.:

GOPA-International Energy Consultants GmbH
Justus-von-Liebig-Str. 1,
61352 Bad Homburg v.d.H. Germany
www.gopa-intec.de
Karsten Ley
Dr. Jeremy Gaines
Anil Ghatikar

Maps:
The geographical maps are for informational purposes only and do not constitute recognition of international boundaries or regions; GIZ makes no claims concerning the validity, accuracy or completeness of the maps nor does it assume any liability resulting from the use of the information therein.

Layout:
FINE GERMAN DESIGN, Frankfurt / Main

This document was produced with the financial assistance of the European Union. The views expressed herein can in no way be taken to reflect the official opinion of the European Union.

Table of Contents

List of Tables

List of Figures

List of Abbreviations

Acronym	Definition
AADL	Allied Atlantic Distilleries Ltd.
AC	Alternating Current
AFD	Agence Française de Développement (French Development Agency)
ANSEP	Association of Nigerian Solar Energy Promoters
APC	All Progressives Congress
ARECON	Association of Rural Electrification Contractors of Nigeria (Renewable and Rural Power Department)
ATC&C	Aggregate Technical, Commercial and Collection
BMZ	Bundesministerium für wirtschaftliche Zusammenarbeit und Entwicklung (German Federal Ministry for Economic Cooperation and Development)
BPE	Bureau of Public Enterprise
BPP	Bureau of Public Procurement
CCGT	Combined Cycle Gas Turbine
CCN	Climate Change Network
CCTV	Closed Circuit Television
CDM	Clean Development Mechanism
CEO	Chief Executing Officer
CFC	Chlorofluorocarbon
CFL	Compact Fluorescent Lamp
CNG	Compressed Natural Gas
CREDC	Community Research and Development Centre
CREN	Council for Renewable Energy
CSP	Concentrated Solar Power
DC	Direct Current
DCC	Department of Climate Change
DFI	Development Financing Institution
DFID	Department for International Development
DISCO	Distribution Company
DNI	Direct Normal Irradiation
DPR	Detailed Project Report
ECN	Energy Commission of Nigeria
ECOWAS	Economic Community of West African States
EE	Energy Efficiency
EEB	Energy Efficiency in Buildings
EG	Embedded generation
EIA	Energy Information Agency
EIA	Environmental Impact Assessment
EIS	Electrical Inspectorate Services (former Department of FMP)
EIU	Economist Intelligence Unit
ELPS	Escravos Lagos Pipeline Systems
EMAS	Eco-Management and Audit Scheme
EMIS	Energy Management and Information Systems
EMS	Electricity Management Services Limited
EPC	Engineering, Procurement and Construction
EPIC	Electrical Power Implementation Committee
EPSR	Electricity Power Sector Reform
EPSRA	Electricity Power Sector Reform Act
ESIA	Environmental and Social Impact Assessment
ESMAP	Energy Sector Management Assistance Program
FCT	Federal Capital Territory (Abuja)
FEC	Federal Executive Council
FGN	Federal Government of Nigeria
FHA	Federal Housing Authority
FIPA	Foreign Investment Forum Promotion and Protection Agreement
FIT	Feed-in Tariff
FMBN	Federal Mortgage Bank of Nigeria
FMENV	Federal Ministry of Environment

FMLHUD	Federal Ministry of Land, Housing and Urban Development
FMP	Federal Ministry of Power
FMST	Federal Ministry of Science and Technology
FMITI	Federal Ministry of Industry, Trade and Investment
FMWR	Federal Ministry of Water Resources
FOB	Free On Board
GACN	Gas Aggregation Company of Nigeria
GBCN	Green Building Council of Nigeria
GDP	Gross Domestic Product
GE	General Electric
GEF	Global Environmental Fund
GENCO	Generation Company
GHI	Global Horizontal Irradiation
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (German Agency for International Cooperation)
GOPA-intec	GOPA-International Energy Consultants GmbH
GTI	Global Tilted Irradiation
HCFC	Hydrochlorofluorocarbon
hh	households
hhK	household kerosene
HV	High Voltage
HVAC	Heating, Ventilation and Air Conditioning
IBRD	International Bank for Reconstruction and Development
ICEED	International Centre for Energy, Environment and Development
ICRC	Infrastructure Concession and Regulatory Commission
ICREEE	Inter-Ministerial Committee on Renewable Energy and Energy Efficiency
IDA	International Development Association
IEA	International Energy Agency
IEC	International Electrotechnical Commission
IEDN	Independent Electricity Distribution Networks
IFC	International Finance Corporation
IMF	International Monetary Fund
IOC	International Oil Companies
IPP	Independent Power Producer
ISO	International Organisation for Standardization
JICA	Japan International Cooperation Agency
ktoe	Kilo Tons of Oil Equivalent
KSPP	Karshi Solar Panel Plant
LCOE	Levelised Cost of Energy
LED	Light-emitting Diode
LEED	Leadership in Energy and Environmental Design
LEME	List of Eligible Equipment and Materials
LGA	Local Government Area
LHP	Large Hydropower
LNG	Liquefied Natural Gas
LOI	Letter of Intent
LV	Low Voltage
MAN	Manufacturers Association of Nigeria
MEPS	Minimum Energy Performance Standard
MFI	Main Financial Institution
MIGA	Multilateral Investment Guarantee Agency
MO	Market Operator
MRC	Mortgage Re-financing Company
MSME	Micro, Small- and Medium-Scale Enterprises
MSW	Municipal Solid Waste
Mtoe	Million Tonnes of Oil Equivalent
MYTO	Multi Year Tariff Order
NACAN	National Advocacy Campaign on Adaptation in Nigeria

NACCIMA	National Association of Chambers of Commerce, Industry, Mines and Agriculture
NAE	Nigeria Alternative Energy
NAPTIN	National Power Training Institute of Nigeria
NARAP	Nigerian Association of Refrigeration and Air Conditioning Practitioners
NASENI	National Agency for Science and Engineering Infrastructure
NASPA-CCN	National Adaptation Strategy and Plan of Action for Climate Change in Nigeria
NBET	Nigerian Bulk Electricity Trading Plc
NBS	National Bureau of Statistics
NCCS	National Clean Cooking Scheme
NCEAP	Nigerian Clean Energy Access Program
NCEEC	National Centre for Energy Efficiency and Conservation
NCERD	National Centre for Energy Research and Development
NCHRD	National Centre for Hydropower Research and Development
NCPRD	National Centre for Petroleum Research and Development
NCS	Nigerian Custom Service
NDPHC	Niger Delta Power Holding Company
NEEDS	National Environmental, Economic and Development Strategy
NEEP	National Energy Efficiency Policy
NEMP	National Energy Master Plan
NEP	National Energy Policy
NEPA	National Electric Power Authority
NEPP	National Electric Power Policy
NERC	Nigerian Electricity Regulatory Commission
NESI	Nigeria Electricity Supply Industry
NESP	Nigerian Energy Support Programme
NESREA	National Environmental Standard and Regulatory Agency
NGC	Nigerian Gas Company Limited
NGF	Nigeria Governors" Forum
NGEP	Nigerian German Energy Partnership
NGN	Nigerian Naira (Currency)
NIA	Nigerian Institute of Architects
NIAF	Nigeria Infrastructure Advisory Facility
NIOB	Nigerian Institute of Building
NIPC	Nigerian Investment Promotion Commission
NIPP	National Integrated Power Project
NIS	Nigerian Industrial Standard
NIYAMCO	Nigerian Yeast and Alcoholic Manufacturers
NNPC	Nigerian National Petroleum Corporation
NOO	National Ozone Office
NORAD	Norwegian Agency for Development Cooperation
NPC	National Planning Commission
NREEEP	National Renewable Energy and Energy Efficiency Policy
NSE	Nigerian Society for Engineers
NUMCO	Nigerian Uranium Mining Company
ONEM	Operator of the Nigerian Electricity Market
OPEC	Organisation of the Petroleum Exporting Countries
OPIAMU	Ozone Project Implementing and Management Unit
PACP	Presidential Action Committee on Power
PCHN	Power Holding Company of Nigeria
PDP	People's Democratic Party
PHCN	Power Holding Company of Nigeria
PIB	Petroleum Industry Bill
PMS	Premium Motor Spirit
PPA	Power Purchasing Agreement
PPP	Public Private Partnership

PSF	Petroleum Support Fund
PTFP	Presidential Task Force on Power
PV	Photovoltaic
PVES	Photovoltaic Energy Systems
QIPP	Qua Iboe IPP
RE	Renewable Energy
REA	Rural Electrification Agency
REAP	Renewable Electricity Action Programme
REEEP	Renewable Energy and Energy Efficiency Programme
REF	Rural Electrification Fund
REMP	Renewable Energy Master Plan
REP	Rural Electrification Policy
REPG	Renewable Electricity Policy Guidelines
REPP	Rural Electrification Policy Paper
REPS	Renewable Energy Power Systems
RESP	Rural Electrification Strategy and Plan
RESP	Rural Electrification Strategy and Plan
RET	Renewable energy technologies
RUWES	Rural Women Energy Security
SCADA	Substation Control and Data Acquisition
SERC	Sokoto Energy Research Centre
SHP	Small Hydro Power
SHS	Solar Home Systems
SME	Small- and Medium-Scale Enterprises
SO	System Operator
SON	Standards Organisation of Nigeria
SONCAP	SON Conformity Assessment Programme for Exports
SURE-P	Subsidy Reinvestment and Empowerment Programme
SWH	Solar Water Heaters
TCN	Transmission Company of Nigeria
TEM	Transitional electricity market
TIB	The Infrastructure Bank, Nigeria
TPES	Total Primary Energy Supply
TSP	Transmission Service Provider
UK	United Kingdom
UN	United Nations
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
UN-HABITAT	United Nations Human Settlement Programme
UNHCR	United Nations High Commissioner for Refugees
UNICAL	University of Calabar
UNIDO	United Nations International Development Organisation
UNOPS	United Nations Office for Project Services
US$	United States Dollar (Currency)
USA	United States of America
USAID	United States Agency for International Development
WB	World Bank
WEM	Wholesale Electricity Market
WIS	Wind Information System

Units of Measurement

Unit	Description
Btu	British thermal units
GW	Gigawatt
GWh	Gigawatt hours
kV	Kilovolt
kW	Kilowatt
kWh	Kilowatt hours
ML	Million Litres
MW	Megawatt
toe	Tons of oil equivalent

Exchange Rates

1 Euro (EUR) equals 200 Naira (NGN)

1 US Dollar (US$) equals 160 Naira (NGN)

The Nigerian energy sector has changed fundamentally in recent years. The Nigerian Government has made it clear that it seeks to deregulate and restructure the sector, with the goal to completely unbundle the oil and gas sector and to privatise the power sector. An indication of this approach was the withdrawal of a large percentage of the subsidy on petrol in January 2012, following the deregulation of the diesel market in summer 2009, in an effort to free up revenue for infrastructure investments.

With an installed capacity of 13 308 MW, only 6 158 MW were operational in 2014. Of these, only between 3000 MW to 4 500 MW are actually being generated due to unavailability of gas, breakdowns, water shortage and grid constraints. The poor performance of the power plants has led to acute shortage of power across the country.

Altogether, up to 2 700 MW of power generation capabilities are regularly lost due to gas constraints in a country with one of the largest natural gas deposit in the world. Up to 500 MW are lost due to water management, while several hundred megawatts are regularly lost due to line constraints. Industry, commerce and private households are suffering from a severe shortfall in electricity generation.

With the intention of incentivising private-sector investment in the power sector, the government has privatised the generation and distribution sections in two waves. The proceeds are sensibly being dedicated to infrastructure expansion and, in the case of the second wave, a large part of the revenue has been earmarked for expansion of the country's array of hydropower plants.

However, the process of privatisation is still ongoing. At present it is impossible to say with any certainty whether the independent power producers who now form the backbone of the Nigerian power sector will be commercially viable. As part of the process, however, the government has started to encourage investments in both renewable energy and energy efficiency.

This study is elaborated under the framework of the Nigerian Energy Support Programme (NESP), financed by the German Federal Ministry for Economic Cooperation and Development (BMZ) and the European Union and administered by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), in cooperation with the Federal Ministry of Power and other Nigerian partner organisations.

The Study Purpose

The study seeks to outline the current status of the Nigerian energy sector and to analyse which opportunities this spells for the subsectors of on-grid renewable energy, energy efficiency and off-grid rural electrification.

This study provides national stakeholders, international development partners and private investors with an overview and supplementary baseline information in order to initiate and facilitate the flow of private and public investments into the fields of renewable energy and energy efficiency. The study is based on data gathered from existing databases and a series of interviews conducted in the country from January until October 2014 and feedback received by April 2015.

Any such study is beset by the challenge of identifying reliable data. In the absence of a central electronic data gathering unit in the power sector and conflicting statements made in the context of political agenda setting, data verification by comparison with at least one other data set has been difficult.

Moreover, sources are not always given in studies or papers that offer statistics, meaning citation of such sources is potentially problematic, especially if they are the only source. For the purposes of this study we have consulted national and international data sets for each case.

Structure of the Study

Chapter 2 (Introduction to Nigeria) and Chapter 3 (The Nigerian Energy Sector) give an introduction to the Nige-

rian context, the economy and current status of the energy sector. The latter chapter further deliberates on the current status of ongoing privatisation in the energy sector. Chapter 4 (Energy Market – Stakeholders and Roles) explains the energy market, its stakeholders and their main roles and functions.

Policies and strategies in the fuel and electricity market are outlined in Chapter 5 (Energy Policy). This chapter gives a fundamental overview of the laws, regulations, policies and programmes currently enacted or under discussion.

Chapter 6 (On-Grid Renewable Energy) identifies the immense potential for private investment in renewables today and highlights the role this could play in significantly boosting the national generation capacity. As regards energy efficiency, in Chapter 7 (Energy Efficiency) the study identifies high potential for energy efficiency gains.

In Chapter 8 (Rural Electrification, Including Off-Grid Renewable Energy), the study explores the status of rural electrification in Nigeria today and the policies put in place to increase access to energy. Conclusions and recommendations and are presented in Chapter 9, Concluding Remarks.

Main study findings and recommendations

On-Grid Renewable Energy

The reasoning for on-grid renewables is strong. On the one hand, power plants overcome geographical grid challenges and on the other hand, renewable energies offer fast-delivery solutions and are cost-effective especially when replacing diesel generation capacity. At the same time, challenges are highlighted in what could be a key pioneering area.

The study's main recommendations are:

1. to set-up a structured and reliable support mechanism such as a Bidding System for utility scale (larger than 10 megawatt) renewable energy and a feed-in tariff for small renewable energy projects
2. to focus efforts on development of solar photovoltaic (PV) farms and small hydropower plants (primary focus on quick wins)
3. to link the vast biomass potential to rural electrification schemes
4. to pin-point the wind potential through detailed mapping and the identification of development corridors
5. to align policies between governmental institutions, thus mitigating potential conflicts and to continue the support of the nation's current electricity delivery system
6. to strengthen key stakeholders capacity in order to ensure the achievement of the policy targets and to monitor and evaluate its results based on sound data and reliable statistical records
7. to develop financial and investment instruments including public-private partnerships (PPPs) and promote the contribution of private banks and International Financial Institutions (IFIs)

Energy Efficiency

The energy efficiency market is a start-up market. As part of the process, the government has started to draft mechanisms to encourage investments in energy efficiency through policies, strategies and support provisions. Up to now there is neither real experience, nor historical data available. At the same time, it is now well understood that energy efficiency is a source of energy.

The study's main recommendations are:

1. to familiarise institutions with the concepts of energy efficiency and energy management, and to build capacities for policy development, implementation and monitoring
2. to finalise, approve and operationalise the National Energy Efficiency Policy (NEEP) including the mix of regulatory policy and public financing mechanisms in order to give a clear basis for decision making to investors
3. to develop financial and investment instruments

adapted to each energy efficiency market segment (for example for industry/buildings: to offer incentives through savings from a better conversion rate and for the private household segment: microfinance schemes; non-bank financial institutions; bank consumer loans for appliances; leasing provisions; donor lending programmes)

4. to create a greater government and public awareness in two areas: the use of efficient diesel generators and in the introduction of standards and labels
5. for industry to focus primarily on the establishment of an energy efficiency financing facility designed for small- and medium-sized enterprises (SMEs)
6. for buildings (with a primary focus on public buildings) to develop and implement energy building codes
7. for household appliances to introduce energy efficiency standards as a first priority

Off-Grid Rural Electrification

The study determines that there is great potential for rural electrification and that some of it could be accounted from renewable sources. However, the government will need to address the issue of sourcing of investments. Potentially, this third subsector is the one where government and international donor agencies will need to join forces.

The study's main recommendations are:

1. to finalise, approve and operationalise the Rural Electrification Strategy and Plan (RESP) incl. the mix of regulatory policy and public financing mechanisms
2. to operationalise the Rural Electrification Fund (REF) and IFIs a clear basis for decision making
3. to strengthen institutions to ensure the delivery of the RESP targets including its monitoring and evaluation based on sound data and relevant statistical records
4. for solar PV, to encourage the provision of solar packs (incl. panels and battery storage systems backed up by O&M instructions) for households and microsystem water irrigation pumps
5. for micro-hydro schemes to first evaluate the cost/benefits of run-of-the-river micro systems and of converting micro-dams into hydropower systems
6. for wind, to encourage stand-alone microsystem water irrigation pumps (backed up by instructions schemes on O&M)
7. for biomass, to first assess the prospects of small bio-digesters in line with the biomass resource potential

2. INTRODUCTION TO NIGERIA

The Federal Republic of Nigeria is a federal constitutional republic comprising thirty-six states and the Federal Capital Territory, Abuja. The country is located in West Africa and shares land borders with the Republic of Benin in the west, Chad and Cameroon in the east, and Niger in the north. Its Atlantic coast runs along the Gulf of Guinea, in the south.

The following chapters will summarise key aspects around the geography, climate, political situation, demography, economy and Nigeria's regional context.

2.1 Geography, Climate and Political Situation

2.1.1 Geography

Since 1991, the capital city is Abuja. At its widest, Nigeria measures about 1,200 km from east to west and about 1,050 km from north to south. The country's topography ranges from lowlands along the coast and in the lower Niger Valley to high plateaus in the north and mountains along the eastern border. The country is bifurcated by two main rivers, the Niger and the Benue. The ecology

FIGURE 2-1:
MAP OF NIGERIA

(Prepared by GOPA-International Energy Consultants GmbH)

varies from tropical forest in the south through savannah to the sub-Sahel zone in the far north. Figure 2 – 1 shows the map of Nigeria.

TABLE 2 – 1: NIGERIA´S GEOPOLITICAL ZONES WITH CORRESPONDING STATES AND LAND MASS

Geopolitical Zones	States	Land Area in km²
North-Central	Abuja-FCT	7,607
	Benue	30,800
	Kogi	27,747
	Kwara	35,705
	Nasarawa	28,735
	Niger	76,469
	Plateau	27,147
North-East	Adamawa	38,700
	Bauchi	49,119
	Borno	72,609
	Gombe	17,100
	Taraba	56,282
	Yobe	46,609
North-West	Kaduna	42,481
	Kano	20,280
	Katsina	23,561
	Kebbi	36,985
	Jigawa	23,287
	Sokoto	27,825
	Zamfara	37,931
South-East	Abia	4,900
	Anambra	4,865
	Ebonyi	6,400
	Enugu	7,534
	Imo	5,288
South-South	Akwa-Ibom	6,900
	Bayelsa	9,059
	Cross-River	21,787
	Edo	19,187
	Delta	17,108
	Rivers	10,575
South-West	Ekiti	5,435
	Lagos	3,671
	Ogun	16,400
	Ondo	15,820
	Osun	9,026
	Oyo	26,500
TOTAL km²		**917,434**

(Prepared by GOPA-International Energy Consultants GmbH)

The Federal Republic of Nigeria is divided into six geopolitical zones and 36 federal states. Table 2 – 1 and Figure 2 – 2 show the federal states and the Federal Capital Territory, Abuja.

2.1.2 Climate

Temperatures across the country are relatively high, with very narrow variation in seasonal and diurnal ranges, and wide regional differences. There are two main seasons: the rainy season (usually April to October); and the dry season (November till March). The dry season commences with Harmattan winds, a dry chilly spell that lasts till February and is associated with lower temperatures and dust brought by the winds blowing from the Arabian Peninsula across the Sahara. The second half of the dry season, namely February till March, is the hottest period of the year (temperatures range from 33 to 38 °C and are at their highest, as is aridity, in the north). Given this climatological cycle and the size of the country, there is a considerable variation in total annual rainfall across the country, both from south to north and, in some regions, from east to west. The maximum total precipitation is generally in the southeast, along the coastal area of Bonny and east of Calabar, where mean annual rainfall is more than 4,000 millimetres. A table of annual rainfall by state is included in Annex 1, Table A – 1.

Köppen-Geiger classified the world into climate zones. A world map of climate zones has been updated by [Peel, M. C., Finlayson, B. L., and McMahon, T. A; 2007]. According to this world map, Nigeria has five climatic zones ranging from tropical rainforest climate in the south to dry desert climate in the north (cf. Annex 1, Figure A – 1). Examples of climate charts for different locations across Nigeria, namely for Kano, Minna and Lagos are shown in Annex 1, Figure A – 2, Figure A – 3 and Figure A – 4.

2.1.3 Political Situation

After decades characterised by intermittent civilian rule and military leadership, Nigeria has been ruled democratically since 1999. The political system is a presidential democracy with parliamentary responsibility distributed

across a bicameral system of a senate and a house of representatives.

The party system has gone through a transformation process where the People's Democratic Party (PDP) has relinquished much political power and faces a strong opposition. In February 2013, the All Progressives Congress (APC) arose as the result of a merger by Nigeria's four biggest opposition parties.

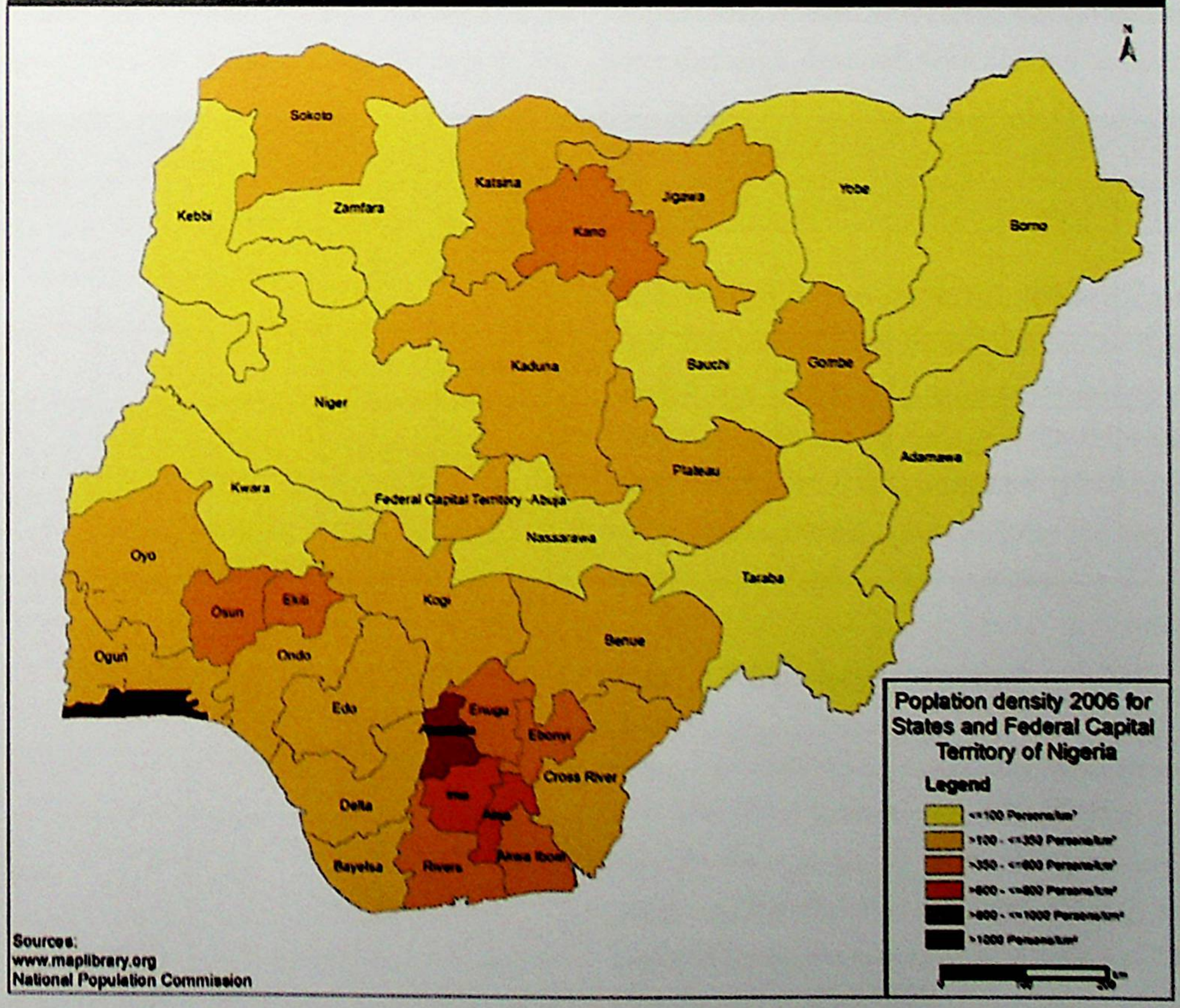
In April 2015, former military ruler Muhammadu Buhari (APC) has become the first opposition candidate to win a presidential election in Nigeria. He already ruled Nigeria from January 1984 until August 1985 after staging a military coup. His predecessor, Goodluck Jonathan (PDP), led Nigeria since 2010.

Nigeria has suffered from several attacks by the Islamist militant group Boko Haram, which is especially active in the North Eastern geopolitical zone. The group has killed thousands of people in its strive to establish an Islamic state.

2.2 Demography

With a population of over 170 million, Nigeria is the most populous country in Africa and the eighth most populous country in the world. According to the United Nations, one in six Africans is Nigerian. It is a regional power, listed among the "Next Eleven" economies, and a member of the Commonwealth of Nations. The current population density varies among the Nigerian states. States in the north east and north west tend to be less populated (cf. Figure 2 – 2). There is only one state with

FIGURE 2-2:
POPULATION DENSITY IN NIGERIA IN 2006



[Prepared by GOPA-International Energy Consultants GmbH]

more than 1,000 inhabitants per square kilometre, namely the megacity of Lagos with a population rate of 2,695 persons/km² and a total population of 9,113,605 in 2006 [NBS; 2011] (cf. Figure 2 – 2). [25], [60] Approximately half of the inhabitants live in urban areas.

The population growth rate is projected to be between 2.5 and 2.7% per annum in the next 20 years. The population of Nigeria is therefore forecast to potentially grow to 310 million by 2035 (cf. Annex 1, Table A – 2). A total of 54.4% of the population were living below the international poverty line of US$ 1.25 per day in 2011 according to the World Bank [25], [60]. Moreover, 46% of the population live below the national poverty line[1]. A middle class has been fast emerging in recent years, especially in the cities.

2.3 Economy

Nigeria's Gross Domestic Product (GDP) was revised in 2013. GDP is typically measured by reference to the shape of the economy in a "base" year. Statisticians sample businesses in different industries to see how fast they are growing. The weight they give to each sector depends on its importance to the economy in the base year. Naturally, these figures become less and less accurate over time. Nigeria's old GDP data relied on an outdated snapshot of its economy in 1990. The new figures (which have 2010 as the base year) give due weight to fast-growing industries such as mobile telecoms and film-making that have sprung up since then. Moreover, Nigeria's statisticians have improved the gathering of data. For instance, the old GDP figures were based solely on estimates of output. The new ones are now being reconciled with separate surveys of spending and income.

As a consequence of the re-basing, the estimate for Nigeria's GDP in 2013 was revised upward from 42.4 trillion Naira to 80.2 trillion Naira ($500 billion), an 89% increase (cf. Table 2 – 2). With the re-based GDP, Nigeria overtook South Africa and is now the largest economy on the continent.

TABLE 2 – 2:
NIGERIA MACROECONOMIC INDICATORS BEFORE[1] AND AFTER RE-BASING[2]

Year	1980*	1985	1995	2005	2010	2011	2012	2013	2014[3]	2015[3]	2016[3]
GDP, current prices, US$ billion	60.6	26.0	36.9	112.2	369.1	414.1	461.0	515.0	581.9	597.8	661.4
GDP nominal growth, (%)	-	-57.1	17.4	142.0	15.32	13.87	11.68				
Real GDP growth (%)					7.8	4.9	4.3	5.4	6.2	5.6	6.5
GDP per capita, current prices, US$**	885	331	356	824	2,396	2,612	2,835	3,082	3,416	3,677	

[1] Source: [IMF; Oct 2013]

[2] Source: [EIU; 2014]

[3] EIU estimation and forecast

* 1980 - 2005 figures: before rebasing (italics), figures for 2010 onwards after rebasing

** from 2010 onwards AfDB data [80]

[1] National estimates are based on population-weighted subgroup estimates from household surveys. World Bank data are based on World

The nominal GDP growth rate was 11.68 % in 2012 and according to the Economist Intelligence Unit [EIU; 2014] real GDP is expected to further grow at a constant rate of around 7% per year. Based on old data (i.e. before rebasing) it could be concluded that the non-oil sector drove the economy, with average growth of about 10% in 2012, compared to –0.35% for the oil and gas sector [IMF; Oct 2013]. High consumer demand was the main force behind non-oil sector growth.

The inflation rate averaged 12% over the last 20 years and stood at 8.1% in 2014.

The Nigerian economy still suffers from inadequate diversification in the wake of first commercial oil production in the late 1950's and the collapse of the nascent manufacturing sector from the mid-1980's onwards. For example, since that time car assembly in Nigeria has ceased and the tire industry has collapsed. The sporadic availability of electricity still forces manufacturers to deploy diesel generators for reliable electricity supply. In consequence this induces uncompetitive electricity cost and frequently leads to factory closings (further details in Chapter 3).

TABLE 2–3:
SECTORAL SHARES OF GDP IN PERCENT, 2012

%	New	Old
Agriculture	22.1	33.1
Crude Oil and Gas	15.8	37
Trade	16.5	15.5
Manufacturing	7.4	1.9
Of which food and tobacco	4.4	-
Construction	3.1	1.3
Transportation	1.3	1.6
Telecommunications	8.3	0.8
Electricity and Gas	0.5	0.2
Finance and Insurance	2.8	1.6
Real Estate	7.7	4.5
Entertainment, Broadcasting, Motion Pictures, Music	2.0	-
Public Administration	3.1	-
Prof., Scientific and tech. services	3.7	-
Other	5.7	2.5

Source: [NBS 2014]

The top five drivers of the economy are the following sectors: agriculture, trade, oil and gas, information and communications, and manufacturing. These top five sectors represent more than 70% of total GDP [NBS; 2014]. The main businesses are cement production, light industry (aluminium processing, paints), food and beverage packaging, as well as subsectors supplying the oil and gas industry. The latter are increasingly indigenous operations.

The country has about 70 million hectares of farmland, primarily located in the Middle Belt, with areas in the sub-Sahel zone largely untouched to date owing to a lack of irrigation capacity. Despite this agricultural potential, less than 50% of the total farmland in Nigeria is cultivated, and agricultural productivity is low because of the lack of modernisation. Nigeria today imports food to meet domestic demand, with the import bill for wheat, rice, sugar and fish estimated at NGN 1 trillion (US$ 6.4 billion) per annum. Agriculture sources some 20% of GDP and employs about 70% of the work force. [1]

These main drivers of economic growth do not require large amounts of labour and thus fail to absorb the 1.8 million new annual entrants into the labour market. The unemployment rate according to the definition of the International Labour Organisation (ILO) is below 10%, while a stricter definition applied by the Nigerian government sets this figure at 24% for 2011.

2.4 Regional Context

Nigeria is West Africa's powerhouse in terms of population and GDP. It represents 55% of West Africa's GDP, whereby for instance the GDP of Lagos is larger than that of Ghana. Nigeria's rebased GDP (cf. Chapter 2.3) makes Nigeria the largest economy in Africa and the 26th largest economy in the world.

Nigeria is a driving force on the continent through its strategic and financial leadership in the Economic Community of West African States (ECOWAS). Abuja has been home to the ECOWAS headquarters since the organisation was founded in 1975. Conversely, Nigeria's internal problems dog the sub-region, and commentators have suggested this has led to the stalling of the political and economic integration of ECOWAS. At the same time, Nigeria provided the African Union contingent in Mali and is driving economic growth in the region, with Nigerian companies investing in many other West African countries.

Nigeria is also part of the West African Power Pool (WAPP), a specialized institution of ECOWAS. The target of WAPP is to ensure regional power system integration and realization of a regional electricity market. It covers public and private generation, transmission and distribution companies.

3. THE NIGERIAN ENERGY SECTOR

The power sector in Nigeria is seen by many analysts as the key constraint on economic development. Assessing the ease of getting electricity, the World Bank ranked Nigeria 187 of 189 countries in the 2015 edition of its Doing Business report. For a business in Lagos, to obtain permanent electricity connection takes 260 days [WB; 2014: b]. Once connected to the electricity provider, Nigerian businesses' biggest reported problem is the erratic power supply. About 83% of all managers surveyed considered electricity outages to be a serious problem – more than any other constraint. Firms of all sizes, in all states and sectors, report average power outages equivalent to eight hours per day. The average firm claims outage related losses equivalent to more than 4% of sales. No peer country experiences such severe business losses related to the power supply. [World Bank (WB); 2011]

The underlying reasons for the negative development regarding electricity supply in Nigeria are apparent. Investment in the nationalised power sector had seriously diminished by the early 1990's, with maintenance budgets greatly reduced and no new capacity added. This statement applies to both the national grid and the fleet of power stations. The gap between the latter's nameplate capacity and actual generation capacity widened constantly by the end of the 20th century and is still the main barrier to stable and reliable energy supplies to the Nigerian consumers.

Alarmed by the critical electricity supply situation the government privatized the electricity sector in 2013 with the aim to improve the reliability of electricity supply (cf. Chapter 3.4) [75]. However, the restructuring of the sector will inevitably take its time and will only gradually alter the reliability of the system.

In addition to the challenges caused by its weak electricity sector, Nigeria also faces challenges in its historically strong oil industry.

Nigeria is Africa's largest oil producer and in 2012 was the world's fourth largest exporter of liquefied natural gas (LNG from associated petroleum gas). Against this backdrop it is no surprise that mining and quarrying (incl. crude oil) is one of the top 5 drivers of the Nigerian economy. While oil only contributes 16% the GDP, it accounts for approx. 75% of Government revenues and 90% of export earnings.

However, Nigeria's oil production is at present impeded by the challenges of oil theft and supply disruptions caused by pipelines being sabotaged or failing. The gas sector is restricted by the ongoing shortfall in infrastructure to monetise gas that is presently flared[2]. And even though Nigeria is among the leading exporters of crude oil in the world, it still imports about 85% of its refined petroleum products due to low capacity utilisation of its domestic oil refineries (around 30%). While the price of petrol at the pump is still subsidised in order to compensate for the high prices of international traded refined oil,[3] the diesel price was deregulated in 2009. This significantly increased the cost of private electricity generation.

Due to the high dependence of the Nigerian economy on its oil industry, changes in oil prices in the international market naturally have a big impact on Nigeria's overall revenue. Accordingly, the sharp fall in oil prices between July 2014 and January 2015 has resulted in a 28 % drop of Nigeria's revenue. [76]

3.1 Energy Resources

According to the Organisation of the Petroleum Exporting Countries (OPEC), Nigeria, Africa's largest oil producer has about 37 billion barrels of proven oil reserves and 187 trillion cubic feet of proven natural gas reserves. With an average production of approx. 1.8 to 2.4 million barrels of oil per day, Nigeria is ranked seventh largest OPEC crude oil producer between 2009 and 2013 [47]. To date, there has been no dedicated gas exploration, and

---

[2] Efforts are being made to promote foreign direct investment in the domestic gas infrastructure. One project of note is the planned Delta Gas City in Ogidigben, Warri-South Local Council Area of Delta State. [17], [64]

[3] Petrol subsidies amounted to almost 1 trillion Naira (6.25 billion US$) in 2014, but are likely to be reduced substantially in 2015 due to decrease of oil revenues.

the gas reserves consist solely of associated petroleum gas. While the natural gas reserves remain untapped, Nigeria exported more than 8% of globally traded liquefied natural gas (LNG from associated petroleum gas) in 2012 (4th largest producer worldwide) [63]. Moreover, there are strong coal seams in Kogi and Enugu states that have not yet been mined on a large scale, although plans are already afoot.

Proven reserves of oil and gas are listed in Table 3 – 1. With the current production of fuel, 42 years of extraction of oil and 120 years of extraction of gas remain.

To date, Nigeria has tended to rely on its fossil fuel resources. At the same time, the country since the late 1960's has focused on establishing hydropower plants in order to exploit the great potential available (cf. Chapter 3 – The Nigerian Energy Sector). The country's strong potentials for renewable energy are further described in Chapter 6 – On-Grid Renewable Energy.

3.2 Primary Energy Supply

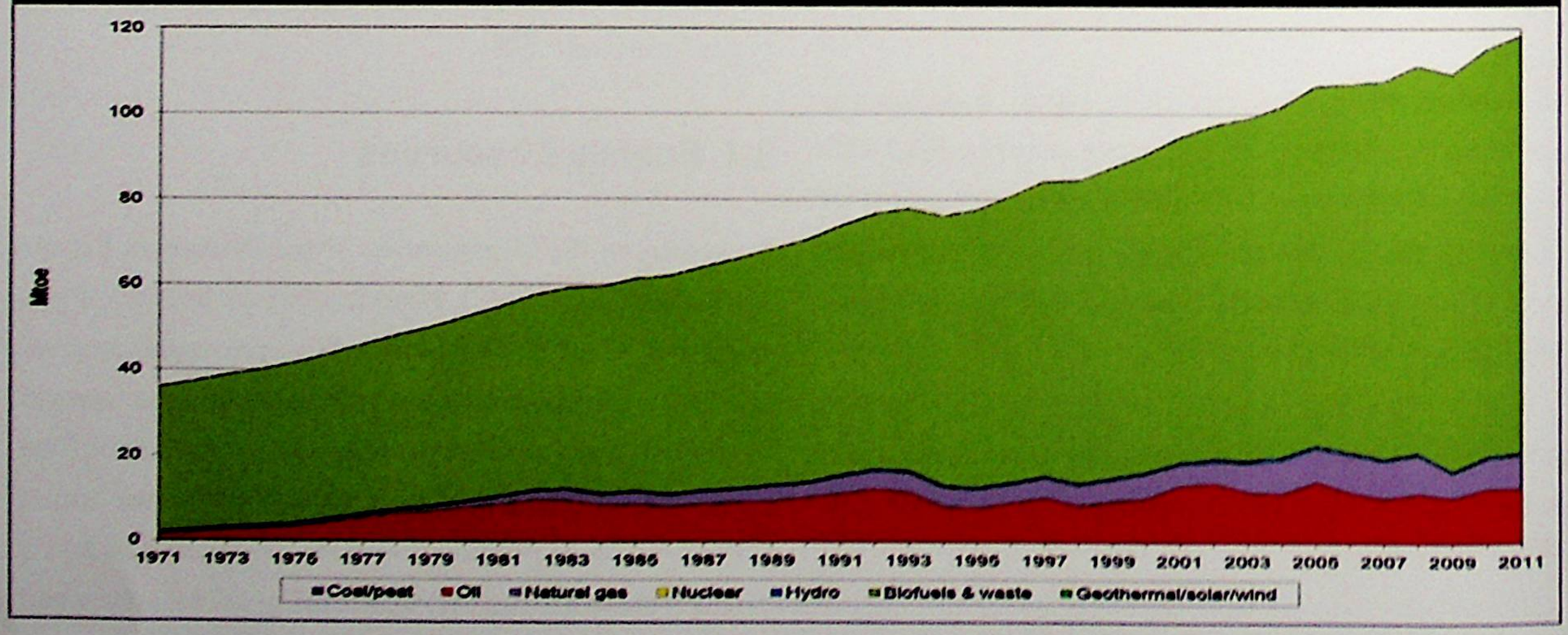
The historic development of energy supply in Nigeria is illustrated in Figure 3 – 1. Since the 1970's the reliance on biofuels and waste has risen in absolute terms, while that of oil and natural gas has remained fairly constant, despite the increase in the extractive industries. Presumably this can be attributed to the cost of oil and natural gas to the consumer, the lack of domestic refining, and the absence of a pronounced infrastructure for domestic gas utilisation. Chapter 8 will further deal with Nigeria's high dependence on biofuels and waste.

TABLE 3 – 1:
OVERVIEW OF FOSSIL FUEL RESOURCES, 2012

	Oil	Gas	Coal (total recoverable)
Reserves	37.2 billion barrels	5.2 trillion cubic metres	209.4 (million short tons) (2008)
Production	2417 thousand barrels per day	43.2 billion cubic metres per year	n/a
Years of extraction remaining	42 years	120 years	n/a

Source: [BP, 2013]

FIGURE 3 – 1:
HISTORICAL TOTAL PRIMARY ENERGY SUPPLY (MTOE) 1971-2011



Source: IEA, [46]

Table 3 – 2 summarizes the energy balances for Nigeria in 2012, based on the statistics from the International Energy Agency [46]. According to this data, in 2012 total Nigerian primary energy supply was 133.7 Million tons of oil equivalent (Mtoe) excluding the electricity trade. The share of biofuels and waste was about 80.9%, while natural gas with 9.4%, oil with 5.7%, and hydropower with 0.4% show significantly smaller shares.

It bears noting that despite being a leading oil and liquid natural gas producer, Nigeria paradoxically imports the fossil-fuel products it currently uses. Accordingly a total of 8.44 Mtoe of oil products was imported. Exports comprise crude oil with 126.4 Mtoe, oil products with 0.8 Mtoe and natural gas with 21.0 Mtoe. This situation is mainly caused by the former mentioned shortage of domestic refining facilities.

TABLE 3-2:
ENERGY BALANCES FOR NIGERIA IN 2012 (KTOE)

Energy Balances for Nigeria in 2012 (ktoe)	Coal and peat	Crude oil	Oil products	Natural Gas	Hydro	Biofuels and waste	Total
Production	30	129,409	0	33,645	487	108,142	271,712
Imports	0	0	8,440	0	0	0	8440
Exports	0	-126,413	-755	-21,032	0	0	-148,201
International marine bunkers	0	0	-397	0	0	0	-397
International aviation bunkers	0	0	-186	0	0	0	-186
Stock changes	0	1830	538	0	0	0	2368
TPES[1] Total Primary Energy Supply	**30**	**4,825**	**7,640**	**12,613**	**487**	**108,142**	**133,736**
TPES (%)	**0.02%**	**3.61%**	**5.71%**	**9.43%**	**0.36%**	**80.86%**	**100.00%**

Source: IEA, [46]

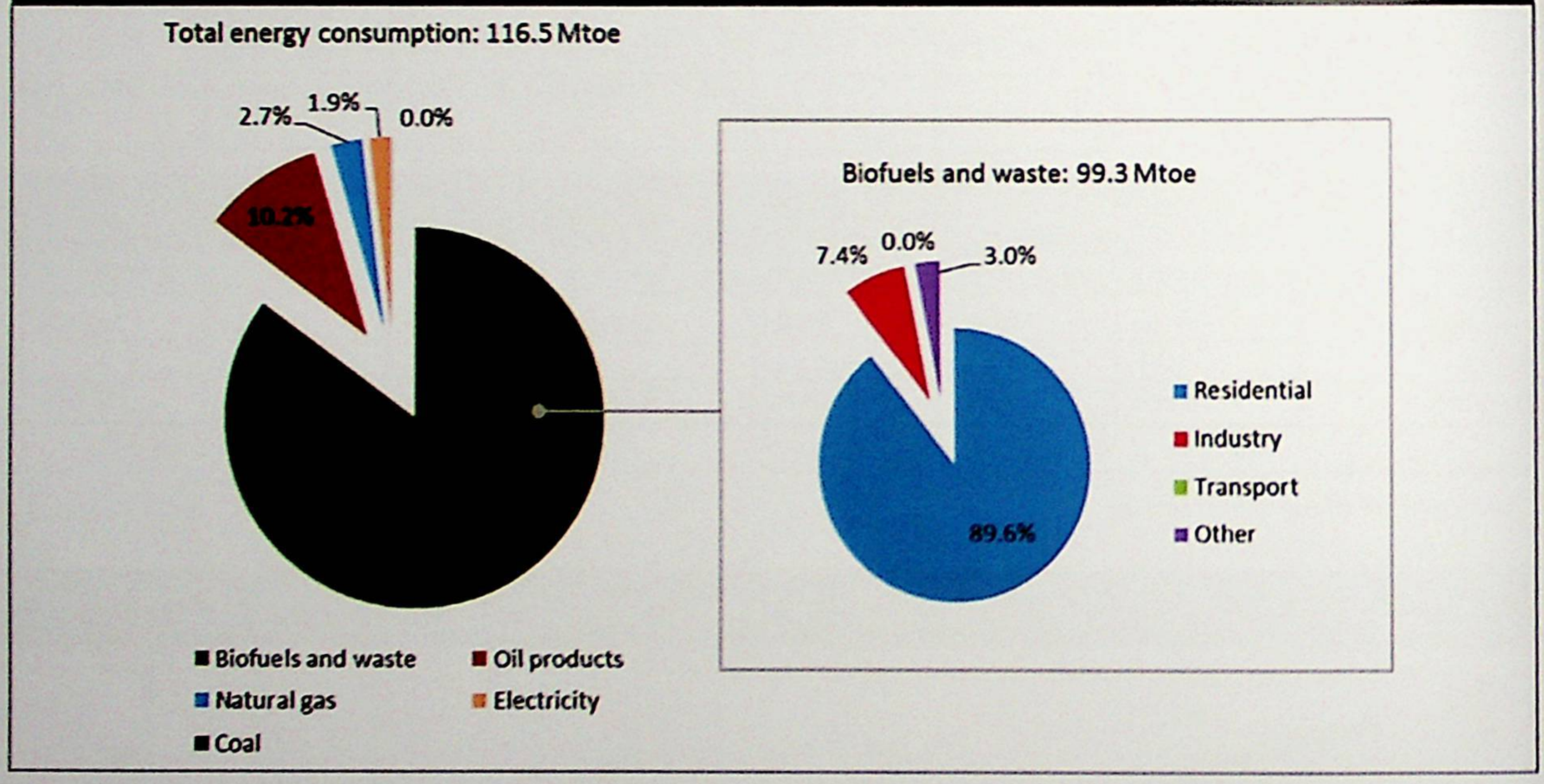
[1] Totals may not add up due to rounding

3.3 Energy Consumption

Figure 3–2 shows the total energy consumption by resources for Nigeria in 2012 [46]. Around 85% of Nigeria's consumed energy, 99.3 Mtoe annually, comes from biofuels and waste. Almost 90% of that energy is consumed for residential usage. This means that biofuels and waste covers about 98% of the energy demand in the residential sector. The lion's share of that most probably is for cooking purposes, as only thus can the predominant proportion of biofuels and waste be explained. The remaining energy in Figure 3–2 stems from conventional energy resources (~13%), with most of it being reimported oil products. The share of electricity in final energy consumption is almost marginal at less than 2%.

The use of biofuels is the single largest factor accounting for the change in the country's vegetation and the increase in desertification[4]. Moreover, the problem will be compounded as the rural population increases in line with the forecast rate of 2.5% p.a.

FIGURE 3–2:
TOTAL ENERGY CONSUMPTION BY RESOURCES IN 2012



Source: IEA, [46]

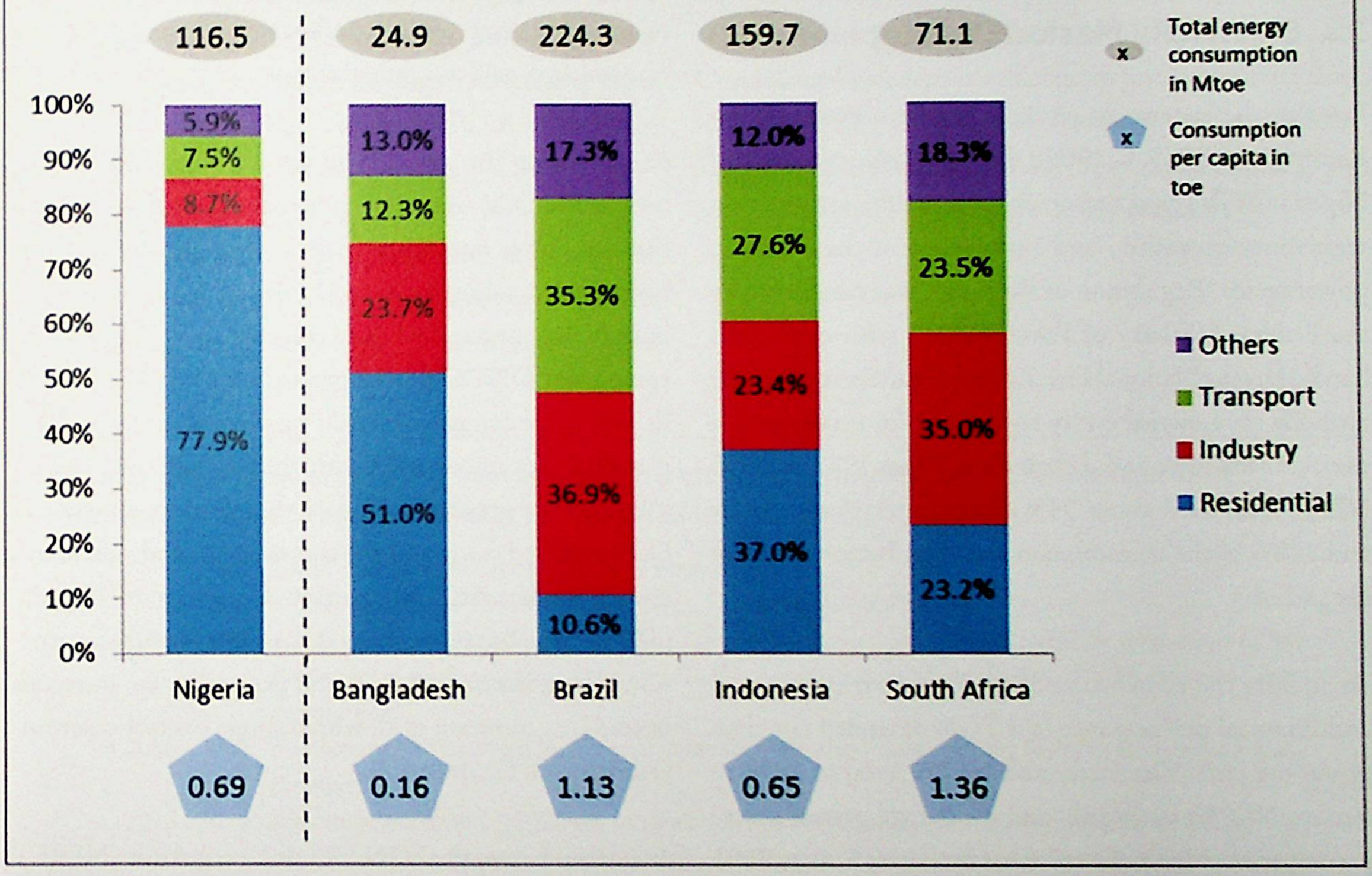
Excursus: Annual fuel wood consumption per person:

Given a population of 170 million, primary energy consumption translates into 6,650 kWh per person. With a cubic metre of wood sourcing 2,600 kWh, per capita consumption of fuel wood is 2.5 m^3. Given, moreover, that about 69.8% of Nigerian population depends on fuel wood for domestic and cottage industry purposes, those using fuel wood for energy purposes are consuming about 3.3 m^3 of wood a year. The situation is compounded by the predominant use of inefficient cooking methods, based largely on open fire with obviously low thermal efficiency and associated smoke related ailments, especially among women and children.

4 The Approved National Forest Policy of 2006 states that between 1978 and 1995, there was a decrease in natural forests from 23,429,100 ha. to 15,097,900 ha. (25.7% to 16.0%), with a decrease in shrub/grassland from 13,441,200 ha. to 11,774,300 ha. (14.8% to 12.9%), while the increase in agricultural land use was from 50,293,500 ha. to 58,497,700 ha. (55.3% to 64.4%)

Figure 3 – 3 illustrates the total energy consumption by economic sectors as well as the consumption per capita for Nigeria and 4 other countries (Bangladesh, Brazil, Indonesia and South Africa), which for the remainder of this study will serve as a peer group.

FIGURE 3-3: TOTAL ENERGY CONSUMPTION BY ECONOMIC SECTORS AND CONSUMPTION PER CAPITA FOR NIGERIA AND PEER COUNTRIES (2012)



Source: IEA, [46]

With a share of about 78%, the residential sector accounts for most of the final energy consumption in Nigeria, followed by industrial use, whereby the latter only amounts to approx. 9%, followed by the rapidly expanding transport sector.

The peer-group comparison reveals that in percentage terms energy consumption in Nigeria is skewed firmly towards the residential sector. All other countries show a much lower share of residential energy consumption. In addition a shortfall in transportation infrastructure can be deducted. The peer group comparison also highlights the problems the Nigerian industry faces, as residential energy consumption outstrips that for industry by a factor of almost nine. Given the substantial proportion of the population that lives in rural areas, electricity generation to drive industrialisation and rural electrification are both policy imperatives.

Figure 3 – 3 also lists the per capita consumption per country. Nigeria's per capita energy consumption of 0.69 toe is almost equal to the figure in Indonesia. South Africa (1.36 toe) and Brazil (1.13 toe) on the other hand have a

significantly higher per capita consumption, while Bangladesh (0.16 toe) shows the lowest per capita consumption of all peers.

Detailed figures comparing Nigeria with its peers are provided in Annex 2 (cf. Table A–4). This comparison reveals that, unlike the peers, Nigeria has by far the lowest total electricity consumption.

3.4 Electricity Market Development

Prior to the enactment of the Electricity Power Sector Reform Act (EPSRA, 2005), the Federal Government of Nigeria (FGN) was responsible for policy formulation, regulation, operation, and investment in the Nigerian power sector. Regulation of the sector was conducted by the Federal Ministry of Power (FMP) with operations handled by the National Electric Power Authority (NEPA), a wholly state-owned entity responsible for power generation, transmission and distribution. From 1972 to 2005, NEPA controlled about 94% of the generation capacity and 100% of the transmission and distribution sector of the industry.

To address the twin issues of NEPA's poor operational and financial performance, the FGN amended the then prevailing laws (Electricity and NEPA Acts) in 1998 to remove NEPA's monopoly and encourage private sector participation. The National Electric Power Policy, 2001, specified the reform agenda, while EPSRA provided the legal basis for the unbundling of NEPA, the formation of successor companies and the privatisation of the latter. The EPSRA envisages a phased implementation of the power sector reforms to strategically guide the current market into a competitive market based on clear regulatory frameworks [75]. Therefore, the evolvement of the Nigerian Electricity Supply Industry (NESI) is designed along four consecutive stages: i) Pre-Transition Stage, ii) Transition Stage, iii) Medium-Term Stage and iv) Long-Term Stage [75].

The Pre-Transition Stage embodies the beginning of the end of the monopoly and kicks off the physical unbundling and privatisation of the NEPA. For this purpose the NEPA was restructured and transformed into the Power Holding Company of Nigeria (PHCN). From 2007 until September 2013 PHCN acted as the state-owned agency responsible for generating, transmitting and distributing electricity for the entire country. Meanwhile the FGN sought to sell-off much of the state-owned stake in the electricity services industry, only retaining the transmission grid as a public entity.

As a first step the government-owned generating companies (GENCOs) were put up for sale in two forms: The thermal power stations were to be sold outright and the hydropower stations were concessioned. Moreover, distribution was unbundled into 11 successor distribution companies (DISCOs) [5]. The privatisation was undertaken in form of a competitive bidding process and was completed in November 2013 with the handover of asset to the 6 private generation and 11 distribution companies. FGN retained control of the transmission and system operation under the Transmission Company of Nigeria (TCN), which has a system and a market operator division. The transmission lines and generators are interconnected in a common grid, with a single control centre at Oshogbo (cf. Chapter 4.3).

As a second step, the FGN founded a regulator (NERC) and a bulk trader (Nigerian Bulk Electricity Trading Plc, NBET), whereby the latter shall only exist until such a time as the electricity market is fully privatised, after which the power purchase agreements it has signed will be passed on to the DISCOs. It also established the Operator of the Nigerian Electricity Market (ONEM) within TCN which acts as wholesale market and settlement operator. It therefore manages the metering system among generation, transmission and distribution companies.

[5] Distribution companies: Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port Harcourt, and Yola

As a third step, the FGN put all ten new National Integrated Power Project (NIPP) power stations up for sale (with a combined capacity of 5,455 MW they were owned by the Niger Delta Power Holding Co. (NDPHC) and scheduled for completion in 2014)[6]. FGN has assigned NGN 50 billion (US$ 312.5 million) to escrow accounts to cushion losses that the GENCOs may suffer (be it from power transmission or due to a shortfall in supplies) and has also obtained a partial risk guarantee from the World Bank to the same end. The Nigerian Bulk Electricity Trading Plc (NBET) manages buying the electricity from the GENCOs and selling it to the DISCOs in the interim. [African Development Fund; 2013]

The Pre-Transition phase was accompanied by interim rules with the objective "to establish a framework to govern trading arrangements during the interim period when power purchase agreements (PPAs) between the privatised generation companies and NBET and vesting contracts between NBET and the privatised PHCN successor distribution companies has not yet become effective" [74].

In order to proceed into the Transitional stage, criteria referred to as Conditions Precedent, which are defined in the Market Rules for Transitional and Medium Stages of the NESI [74], have to be satisfied. In January 2015 the NERC determined that "the level of completion of all Conditions Precedent is sufficient to justify the evolution of the NESI by the commencement of the Transitional Stage Electricity Market (TEM)". Consequently the TEM commenced with effect from 1st of February 2015.

The time line below shows the evolution of the electricity market until commencement of the Transitional Stage Electricity Market (TEM):

2001	adoption of the National Electric Power Policy
2005	enactment of the Electric Power Sector Reform Act (EPSRA)
2005 – 2007	establishment of the Nigerian Electricity Regulatory Commission (NERC); formation of the Power Holding Company of Nigeria (PHCN); unbundling of the PHCN into 18 independent companies
2008 – 2009	publication of the Multi Year Tariff Oder (MYTO); the Power Sector Reform Committee was formed
2010 – 2012	the Nigeria Vision 20:2020 was launched; the Presidential Action Committee on Power (PACP) and the Presidential Task Force on Power (PTFP) were established; the Roadmap for Power Sector Reform was released; the Bulk Trader was established
2012	MYTO II was approved and released
2013	full privatisation of the generation and distribution subsectors; the transmission subsector was retained by Government but its management is currently under concession
2015	MYTO 2.1 was approved and released. Petitions by various consumer groups, evoked by electricity price increases of up to 80%, led to amendment of MYTO 2.1 and a price drop of ~50%
1st of February 2015	commencement of TEM, after NERC declared all Conditions Precedent listed in the market rules as satisfied
May 2015	unbundling of TCN into an Independent System Operator (public) and a Transmission Service Provider (private) has begun

[6] Regarding the generation assets, a distinction is being made between the PHCN Successor Generation Companies (i.e. the existing gas and hydro power plants that were sold to 6 so called private GENCOs), the NIPP projects (gas-fired power plants that were built by the Government and that are currently being sold to private investors) and new Independent Power Producers (IPPs) that will in future build greenfield plants. For more details see Chapter 4.3.

The TEM is characterised by "contract based arrangements for electricity trading and the introduction of competition for entry into the Market" [74]. This means that all electrical trading arrangements are bound by contracts. Hence Power Purchase Agreements (PPA), Vesting Contracts and Gas Supply Agreements, executed during the privatisation process, are effective now [75]. In the TEM ONEM as the market operator sets the financing required for generation, transmission and distribution on the basis of the amended Multi-Year Tariff Order 2.1 (MYTO 2.1). MYTO 2.1 is meant to be a fully cost reflective tariff and is designed to ensure full cost recovery for investors as well as to enforce confidence for financing and investment in the sector. [NERC; March 2015]

In May 2015 the Nigerian Government has begun to unbundle TCN by creating a state-controlled Independent System Operator (which includes the functions of the previous system and market operator divisions) and an eventually privatized Transmission Service Provider.

The third stage of the evolvement of the NESI is the Medium Term Stage and envisages the "introduction of generation competition within the Wholesale Electricity Market and a centrally administered balancing mechanism for the Wholesale Electricity Market" [73]. This stage has not yet been forthcoming.

3.5 Electricity Generation

Within the Nigerian electrical power system four basic power generation options are to be differentiated. These power generation options include i) transmission based on-grid generation, ii) embedded generation, iii) off-grid generation and iv) captive generation. While licenses are needed to operate a generator according to options i) to iii), captive generation only requires a permit by the NERC. In the following, these 4 options are described in more detail. [Detail; 2012]

All existing regulations only affect generation of electricity exceeding 1 MW of installed capacity. Captive generation implies that electricity is entirely consumed by the generator itself (no PPA required), for instance households or companies running their own Diesel generators. Hence captive generation is technically off-grid, meaning that it is not evacuated to the national grid or a distribution grid. Power generation based on an off-grid generation license is obviously also off-grid generation, but additionally requires external off-takers, which typically are households within a remote village, public facilities (e.g. schools, health stations) and/or businesses. A distribution license may also be required for this kind of power generation. On the other hand power generated by means of embedded generation is evacuated through a distribution system of an external distribution company; hence embedded generators are usually connected to the distribution grid. Finally, on-grid generation licenses are necessary for all power plants which evacuate their power on the national transmission grid. [Detail; 2012]

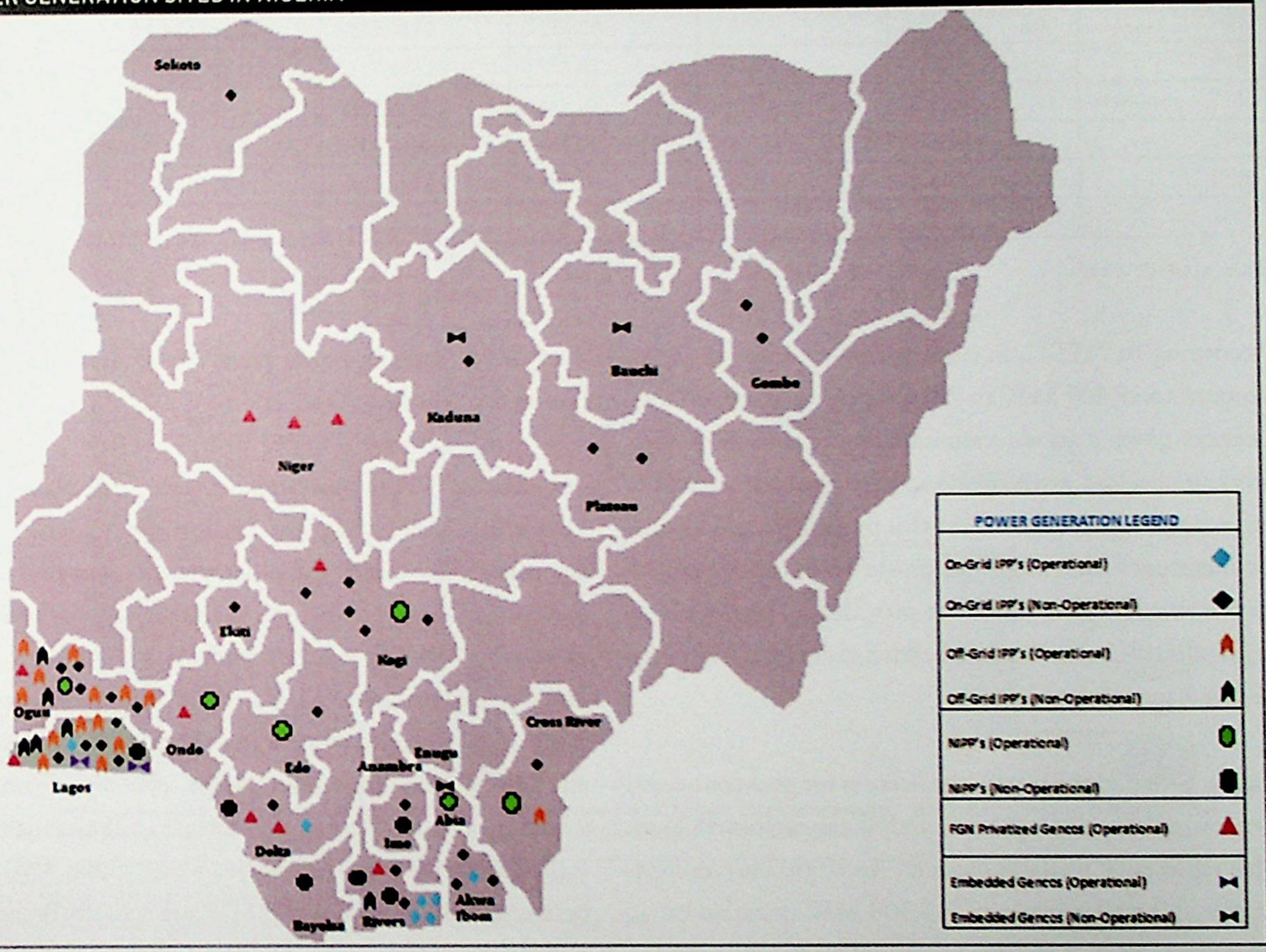
As a result, Nigerian's total power generation is a mixture of the power generation options described above. NERC only provides statistics on power plants connected to the transmission grid (option i). Hence, for generation options ii)-iv), other data sources than NERC statistics have to be taken into account.

In general, there is no comprehensive and commonly accepted database of power statistics,[7] which is why this report uses data from local (NERC, PTFP, National Bureau of Statistics, own surveys) and international sources (World Bank, IEA, United Nations). While efforts were made to validate and harmonize the data, certain deviations across the information depicted in Chapter 3.5 and 3.6 are inevitable.

[7] The National Bureau of Statistics e.g. states that the only source of statistics is essentially PHCN (prior to its unbundling). It comments in this regard: „The PHCN does not have adequate electronic data processing facilities to enable it computerise the production and storage of its administrative statistics. Electricity production and consumption statistics are, therefore, not available in machine-readable form ... „ [23]

The following Chapter 3.5.1 will focus on generation connected to the transmission grid (options i), while Chapter 3.5.2 will further deal with embedded, off-grid and captive generation (options ii – iv).

FIGURE 3-4:
POWER GENERATION SITES IN NIGERIA



Source: [Detail; 2015]

3.5.1 Grid-connected Power Generation

TABLE 3-3:
ELECTRICITY GENERATION PROFILE

Year	Ave. Gen. availability (MW)	Maximum peak generation (MW)	Maximum daily energy generated (MWh)	Total energy generated (MWh)	Total energy sent out (MWh)	Per Capita Energy Supply (kWh)
2007	3,781.3	3,599.6	77,322.3	22,519,330.5	21,546,192.2	155.3
2008	3,917.8	3,595.9	86,564.9	18,058,894.9	17,545,382.5	120.4
2009	4,401.8	3,710.0	82,652.3	18,904,588.9	18,342,034.7	122.0
2010	4,030.5	4,333.0	85,457.5	24,556,331.5	23,939,898.9	153.5
2011	4,435.8	4,089.3	90,315.3	27,521,772.5	26,766,992.0	165.8
2012	5,251.6	4,517.6	97,781.0	29,240,239.2	28,699,300.8	176.4
2013	5,150.6	4,458.2	98,619.0	29,537,539.4	28,837,199.8	181.4
2014	6,158.4	4,395.2	98,893.8	29,697,360.1	29,013,501.0	167.6

Source: NERC Archive

According to NERC, licenses for on-grid power plants amount to 19,407 MW in 2014. By comparison, off-grid licences cover a production capacity of only 305 MW, while embedded generation capacity represents 49 MW (cf. Annex 3, Table A – 7). At this point it should already be mentioned that electrical power from captive generation is much higher than that provided by power plants with off-grid licenses and embedded generators (see Chapter 3.5.2 for further details).

Figure 3 – 5 illustrates how the licenses for grid-connected generation capacity (options i and ii) are combined. Dark blue represents 'available capacity' and light blue 'non-operational installed capacity'. 13,308 MW installed capacity is attributable to the main power plant fleet, the remainder (~31% of licensed capacity) has not yet been build or is under development. Within the existing power plant fleet, NIPP thermal power plants (~40%) and former PHCN thermal power plants (~34%) are contributing the most installed capacity. According to NERC statistics 80% of actual generation capacity in 2015 comes from gas based power plants, while the remaining energy comes from hydro power plants. For installed capacity the ratio is 84% from gas and 16% from hydro. A detailed overview of the existing power plant fleet is attached in the Annex (cf. Annex 3, Table A – 8).

The existing fleet of power plants is a mix of plants built before the 1990's and plants built (or being built) since the mid-1990's. Since the older thermal power stations suffer considerably from poor maintenance, the available generating capacity was just under 6,200 MW in 2012 and has risen to 6 840 MW in 2015. However, unavailability of gas, breakdowns, water shortages and grid constraints severely limit the power plant performance which means that despite an increase in the available installed capacity over the last years (see Table 3.3), only between 3000 MW to 4 500 MW are actually being generated (the highest peak generated ever in Nigeria was 4,517.6 MW on December 23, 2012). Up to 2 700 MW of power generation capabilities are regularly lost due to gas shortage,[8] up to 500 MW are lost due to water management, while several hundred megawatts are regularly lost due to line constraints.

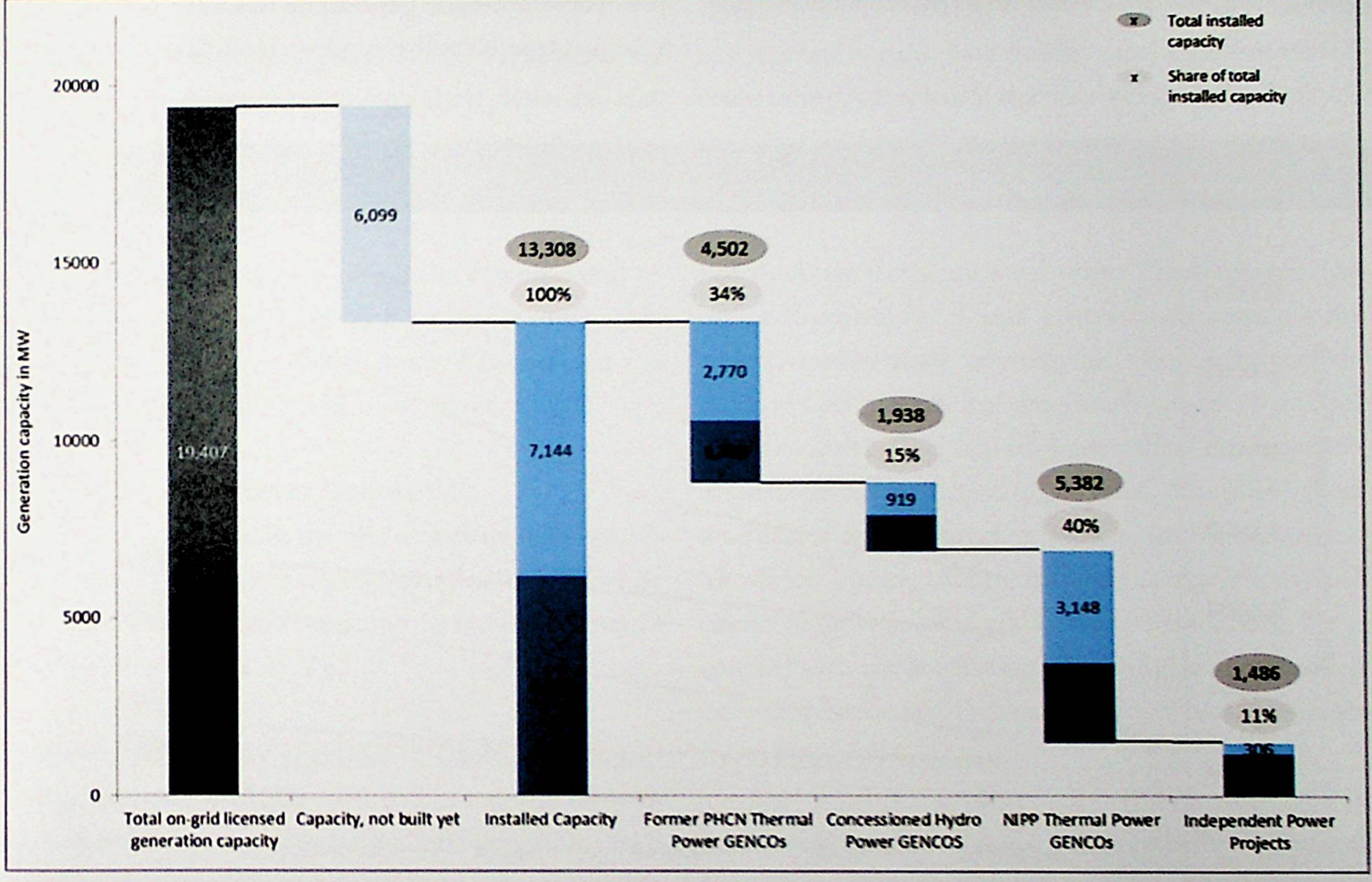
The poor performance of the power plants has led to acute shortage of electricity across the country with power outages of several hours per day.[9] The Presidential Task

[8] Unavailability of gas is mainly due to vandalism of gas pipelines, but also and effect of gas companies rather selling to the more lucrative international market than to the domestic market with regulated prices.

[9] According to GIZ (Mar 2015), businesses tend to suffer about 25.2 electrical outages in a typical month, with an average duration of 7.8 hours, adding up to almost 197 hours of power outages per month (~27% of total hours).

Force on Power regularly publishes the estimated peak demand and peak generation, whereby the former is with 12 800 MW regularly close to four times the latter. The only way the shortfall can be made up is by relying on off-grid electricity generation.

FIGURE 3 – 5:
BREAK-DOWN OF ON-GRID LICENSED POWER GENERATION IN NIGERIA, 2012*

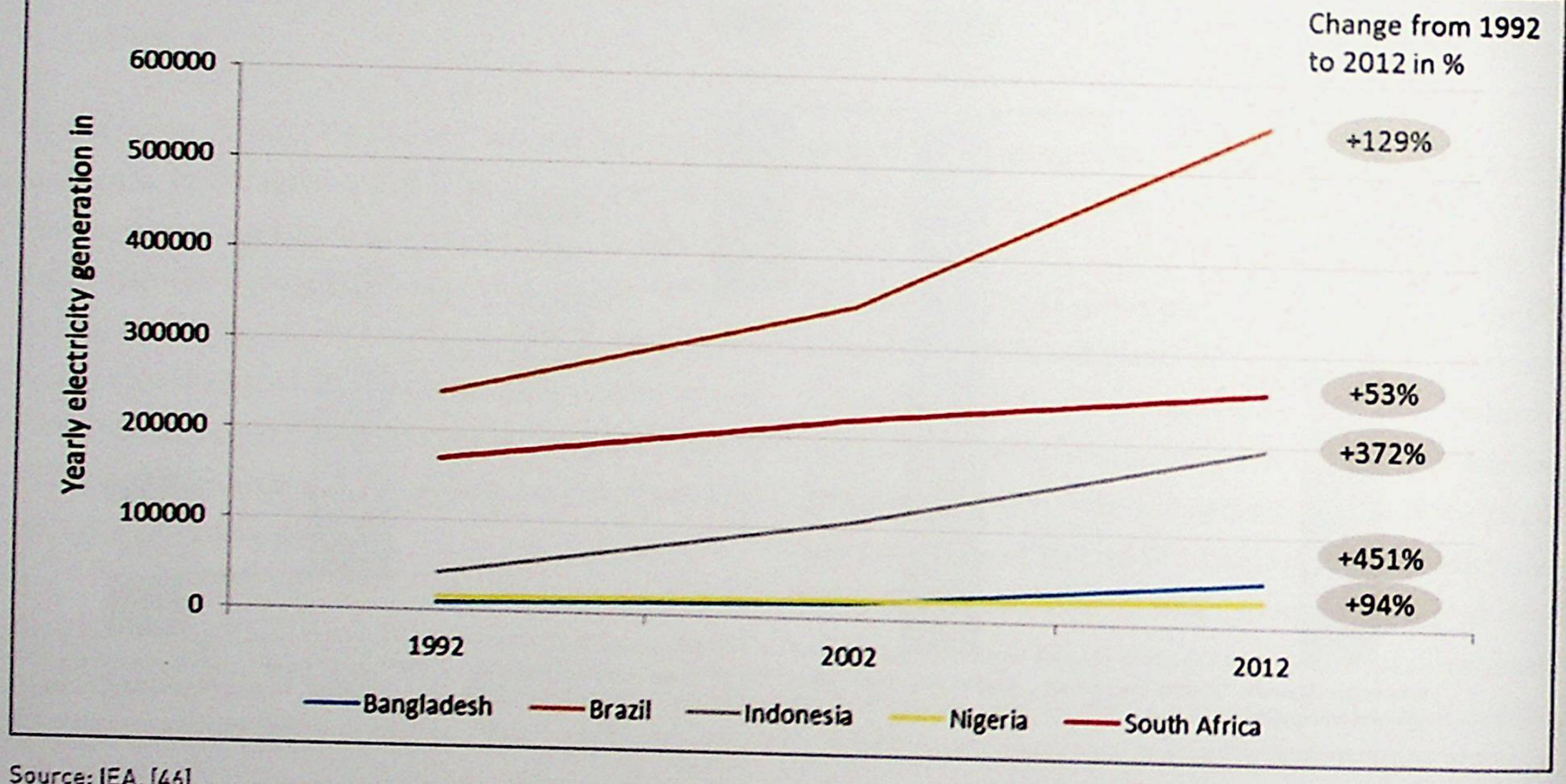


Source: GOPA-International Energy Consultants GmbH
* dark blue = available capacity, light blue = non-operational installed capacity

Table 3 – 3 shows that the electricity production stagnated at about 29 000 MWh over the last years, which means per capita generation actually dropped to a very low 167 kWh in 2014.

Figure 3 – 6 shows the historic development of electricity generation in Nigeria and of the prior mentioned peer countries. It can be observed that Nigeria performed worst of the five countries in terms of absolute electricity generation. Over a 20 year period, there was an increase of 93% in mainline generating capacity in Nigeria. By contrast, Indonesia ramped up its electricity production by 372% and Bangladesh even by 451%. As a result, Bangladesh generated almost twice as much electrical energy in 2012 as Nigeria did.

FIGURE 3 – 6:
ELECTRICITY GENERATION (GWH) IN NIGERIA AND PEER COUNTRIES SINCE 1992



Source: IEA, [46]

Going forward, the Renewable Energy Master Plan (REMP) assumes that the energy generation backbone will remain gas, but the percentage accounted for by coal-fired power plants will further increase [ECN; Nov 2012]. While wind will play only a marginal role, solar power production is expected to outstrip all sources of electricity generation other than gas and thus become the second key pillar of energy delivery in the nation. The structure that could make this possible will be examined in Chapter 6 – On-Grid Renewable Energy.

Two major new gas thermal power plants are being planned at present. One is the Azura Edo Independent Power Producer (IPP) project 459 MW open-cycle gas power plant located in the vicinity of Benin City, in Edo State, Nigeria (Azura). The other is the Qua Iboe IPP (QIPP) 533 MW combined-cycle gas-turbine (CCGT) power plant to be constructed in Ibeno, Akwa Ibom State.

One major hydropower plant is currently under development, the Zungeru 700 MW plant in Niger State. The Gurara 30 MW hydropower plant in Kaduna State and the Kashimbilla 40 MW in Taraba State are two other projects being prioritised by the FGN. Plans to build the 3,050 MW Mambilla hydropower plant in Taraba State have become more concrete since negotiations with the Chinese Exim Bank are ongoing.

In the field of utility-scale solar power projects, there is an array of solar farms that have just obtained licenses or are in the license pipeline. They include a 100 MW facility in Bauchi State, one of 120 MW in Katsina State, and various others in Ekiti, Kaduna, and Nassarawa States. The Ministry of Power has a 10 MW pilot wind plant in Katsina, which is scheduled for commissioning in the near future.

Furthermore, the second phase of NIPPs, focused on building hydro power generation plants, is planned to add 4000 MW of electricity to Nigeria's generation profile (see chapter 4.3. for further details).

Finally, plans are underway to use the domestic coal resources in Enugu und Kogi state for power production purposes; recently, a private company has obtained a license to develop a 1 200 MW power plant.

3.5.2 Off-grid Power Generation

As already mentioned in the previous chapter, off-grid licences cover a production capacity of only 305 MW, while licensed embedded generation capacity only represents 49 MW (cf. Annex 3, Table A-).

However, the majority of private investors active in captive generation usually do so in order to ensure sustainable and stable power supply for their manufacturing facilities. The above listed figures do not account for generation capacity of these privately owned Diesel or gas generators.

According to a 2013 survey, approx. 80% of the Nigerians use alternate sources of electricity supply such as generators or solar inverters.[10] Estimates suggest that between 8 and 14 GW of decentralised diesel generator capacity is currently installed in the country[11]. About 86% of the companies in Nigeria own or share a generator and about 48% of their total electricity demand is covered by these private generators [GIZ; Mar 2015]. With several millions of privately installed Diesel generators, Nigeria leads Africa as a generator importer and is one of the highest importers worldwide, with the total annual import figure being NGN 17.9 billion (US$ 112 million).

Within the Nigerian power system, captive generation offers some distinct advantages. First of all, industrial consumers can generate the power needed for their operations. Secondly, the request for a permit for captive generation involves the least hurdles in terms of financing and regulatory risks. And thirdly, captive generation represents the optimal use of electrical power, since there are theoretically no technical (transmission) or commercial losses to be dealt with.

But there obviously are some major disadvantages. The use of decentralized Diesel generators is economically and environmentally questionable. This is further detailed in Chapter 3.8. Another disadvantage is that a permit for captive generation does not allow for supplying external off-takers. According to [GIZ; Mar 2015], there is an excess of self-generation capacity in the manufacturing sector. Hence, trading between energy surplus and energy negative firms would be beneficial for both, but is coupled with the acquisition of an off-grid or embedded generator license and the management of associated regulatory issues.

In this context the acquisition of an embedded generator license seems more advantageous, since electricity can be evacuated through the existing distribution grid, which makes the acquisition of a distribution license needless. Furthermore embedded generation does not only offer advantages for industrial consumers, but also for states and local governments, which can achieve power supply aspirations within their borders without constitutional constraints. However, the propagation of embedded generation is impeded by missing liquidity of distribution companies, which hinders them to off-take power from potential embedded generators. [Detail; 2012]

---

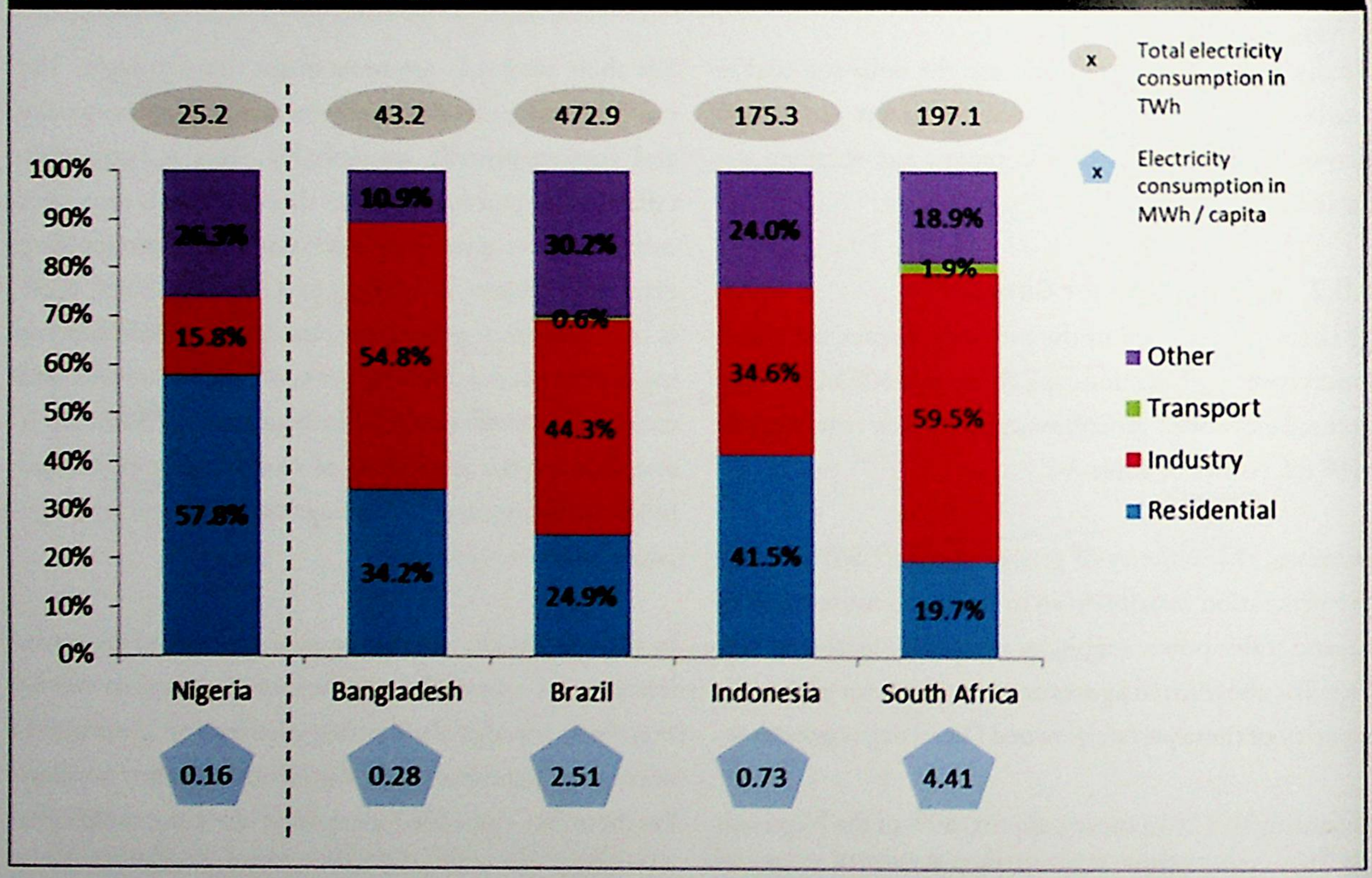
[10] Opinion Polls 47: "Percent of Nigerians Experienced Poor Power Supply in 2nd Quarter of 2013" [45]
[11] GIZ and NIAF estimation

3.6 Electricity Consumption and Demand

3.6.1 Electricity Consumption

The available data on Nigeria for electricity consumption by sector reveals that – similar to energy consumption in general – it is the residential sector that consumes by far the most energy. Figure 3 – 7 illustrates this fact and additionally shows a comparison between Nigeria and the previously defined peer countries.

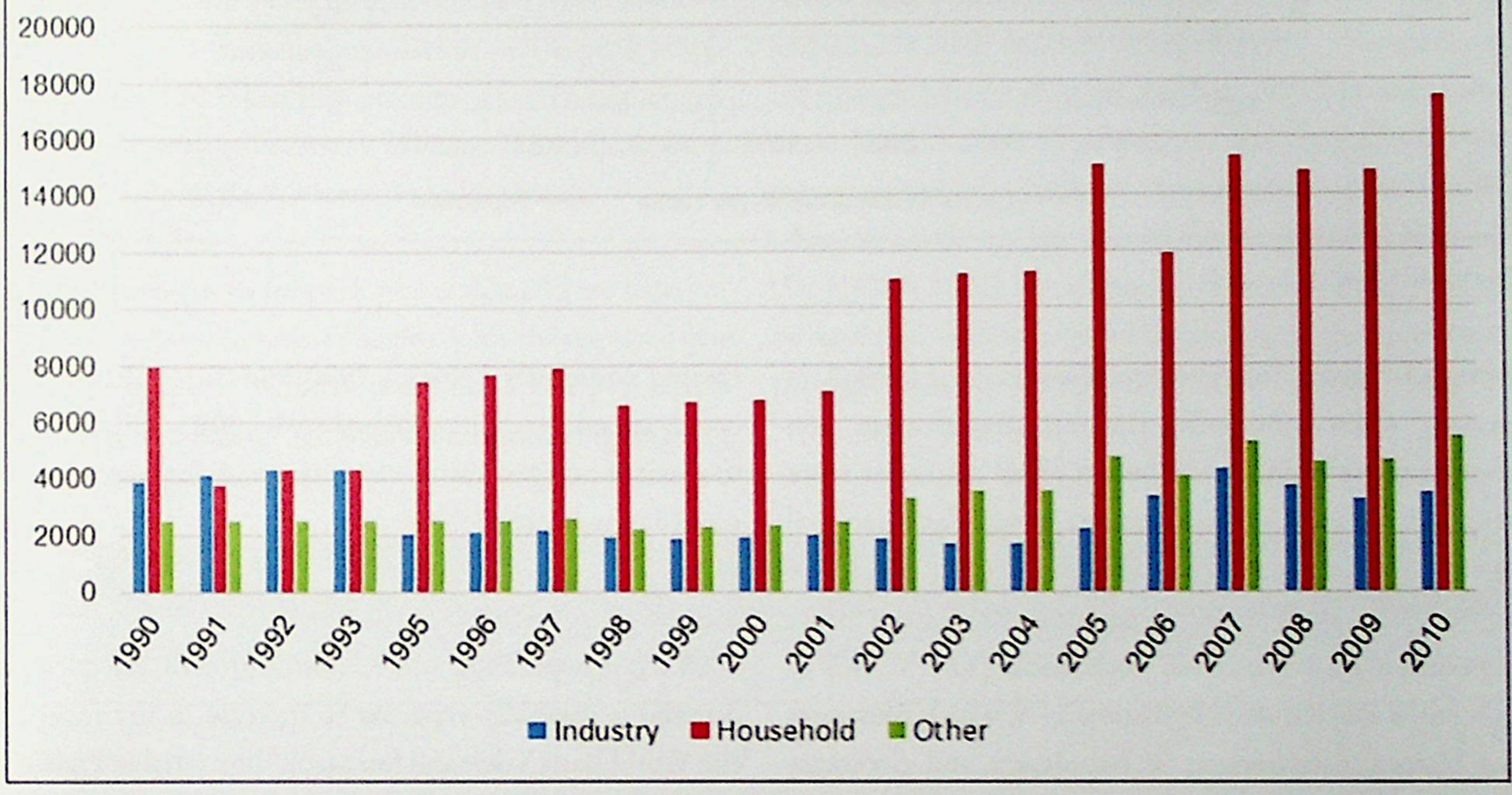
FIGURE 3 – 7: TOTAL ELECTRICITY CONSUMPTION BY ECONOMIC SECTORS AND CONSUMPTION PER CAPITA FOR NIGERIA AND PEER COUNTRIES (2012)



Source: IEA, [46]

Based on data from the International Energy Agency [46], residential usage accounts for almost 58% of the final electricity consumption in Nigeria. Likewise it is the residential sector (households) where the increase over the ten-year period depicted in Figure 3 – 8 is most pronounced.

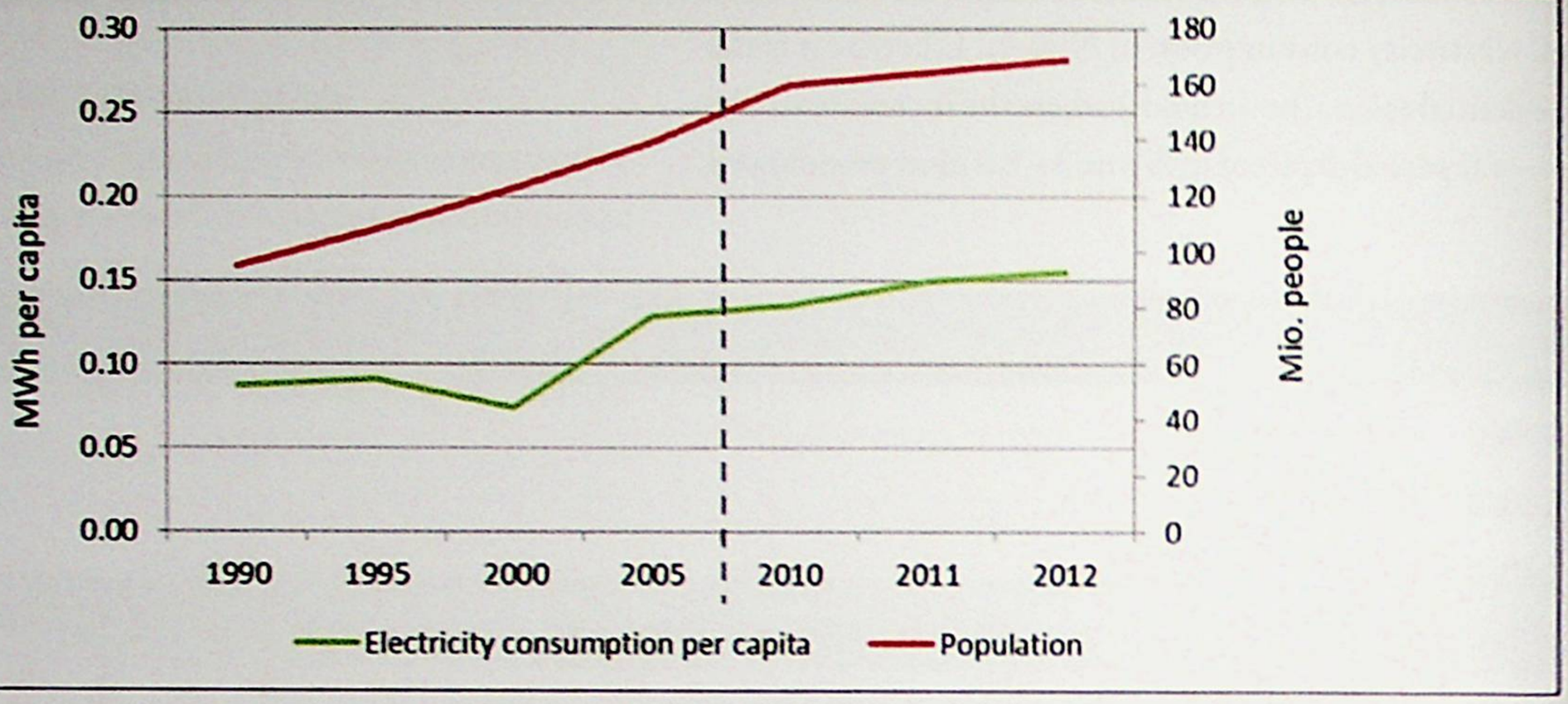
FIGURE 3–8:
NIGERIAN ELECTRICITY CONSUMPTION (MILLION KWH)



Source: UN Stats, [62]

All peer countries, represented in Figure 3 – 7, show a significantly lower share of residential electricity consumption accompanied by a much higher share of industrial electricity consumption. In addition to that, overall electricity consumption and electricity consumption per capita are also much higher for the peer countries [46]. However, these figures do not account for captive generation from decentralized Diesel generators, which outstrips the available grid-connected capacities (see Chapter 3.5.2). When taking this privately owned generating capacity into account, the share of industrial consumption is within the range of figures from peer countries. This discrepancy between grid-connected figures and real generation power has to be kept in mind throughout this study.

FIGURE 3-9:
HISTORIC DEVELOPMENT OF POPULATION AND ELECTRICITY CONSUMPTION PER CAPITA IN NIGERIA FROM 1990-2012



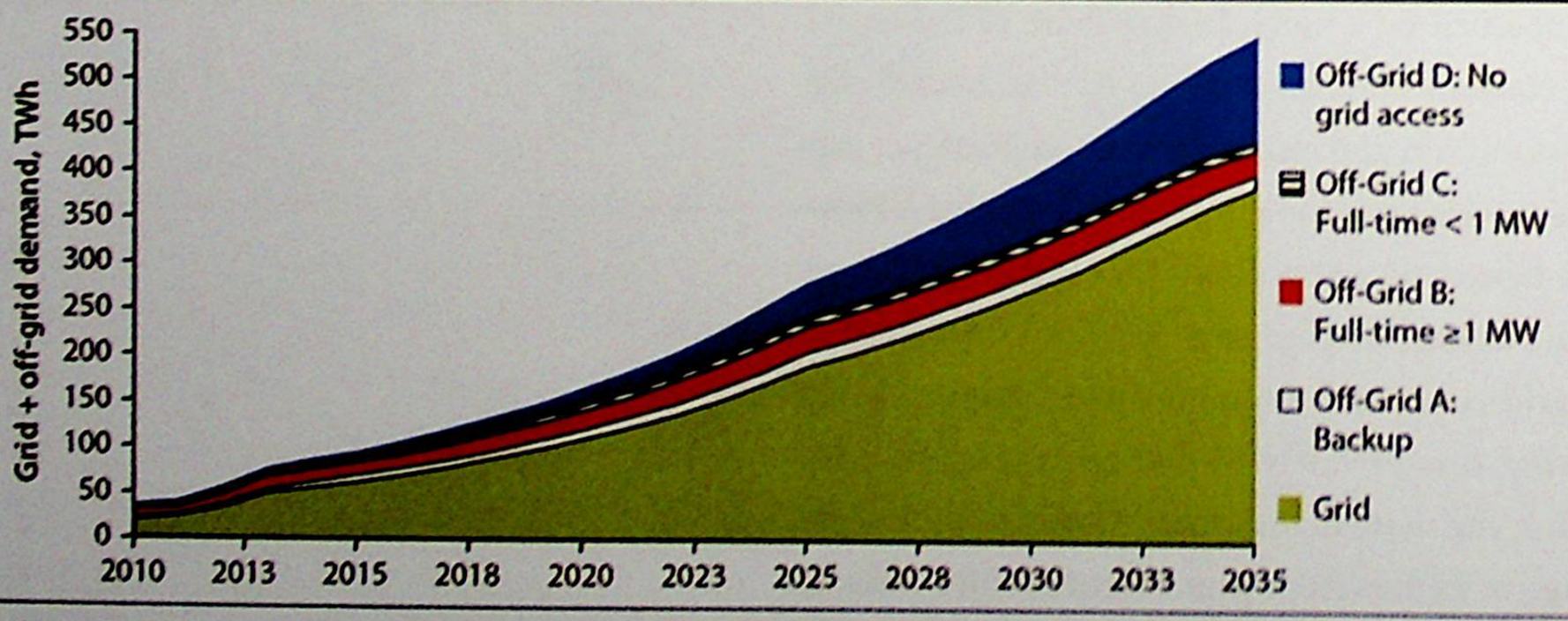
Source: IEA, [46]

Altogether, generation power still seems to lag behind, especially when considering the fact that absolute consumption per capita is the lowest of all countries represented in Figure 3 – 7. Furthermore Bangladesh managed to increase its electricity consumption per capita from 0.05 MWh to 0.28 MWh in the same time period, while experiencing a comparable population growth. This argument is also enforced by Figure 3 – 9, which illustrates the historic development of population and electricity consumption per capita in Nigeria. While population increased constantly between 1990 and 2010, electricity consumption per capita dropped until 2000 – mainly due to a lack of new generation capacity – and only since then started to increase slightly.

3.6.2 Electricity Demand

With a fast population and economic growth, electricity demand is generally expected to increase in the future. The World Bank's demand forecast is illustrated in Figure 3 – 10 [WB; 2013].

FIGURE 3-10:
PROJECTED GRID AND OFF-GRID ELECTRICITY DEMAND IN TWH



Source: Calculations based on FMP and Power Holding Company of Nigeria data and UN 2010 rural/urban population data (for off-grid D projections) listed in the chapter 3 references.

Figure 3 – 10 shows a strong increase in the yearly electricity demand, mainly driven by on-grid demand and – from 2020 onwards – also from off-grid demand (blue area, no grid access). According to the World Bank's projection, electricity demand is to grow by a factor of over 5 until 2035 up to almost 530 TWh. This demand could be satisfied by generators with a capacity of ~63 GW, which would have to run throughout the year at maximum output level. Since 100% utilization of all power plants is unrealistic and transmission losses as well as peak power demand are not taken into account yet, even higher generation capacity is necessary for ensuring sufficient supply, if the World Bank's scenario holds true.

Further projections for peak power demand are listed in Table 3 – 4 and can be used as proxy for the required generation capacity. It should be noted that PTFP projections are based on existing infrastructure, considering ongoing and planned projects. Other estimations are based on scenario assumptions regarding population, GDP and structural changes in the economy, which is why the different projections for peak power demand show a big spread. While Agusto & Co. suggests that peak demand will rise to 41,133 MW by the end of 2015 and 88,282 MW by the end of 2020 respectively, Tractebel Engineering performed an independent demand analysis in 2007, and derived a peak power demand of only 11,433 MW in 2020 and 24,208 MW in 2030 [PHCN; 2007]. The Renewable Energy Master Plan [ECN; Nov 2012] provides the most detailed demand projections and estimates a peak power demand in 2020 of approximately 45,490 MW, which lies in the middle of both figures mentioned before [ECN; Nov 2012]. For all cases generation capacity has to be increased significantly, while the huge differences show the importance of a proper demand forecast.

TABLE 3–4:
COMPARISON OF ELECTRICITY DEMAND PROJECTIONS (MW)

	2014	2015	2020	2025	2030	2035	2040
Agusto & Co.	12,800	41,133	88,282	-	-	-	-
Renewable Energy Master Plan (reference growth 7%)	-	24,380	45,490	79,798	115,674	161,651	213,122
Presidential Task Force on Power (PTFP)	-	12,800*	-	-	-	-	-
PTFP, distribution capacity	10,648	-	32,774	-	-	-	-
Tractebel Engineering	-	-	11,433	-	24,208	-	-

* www.nigeriapowerreform.org (peak demand forecast, April 2015)

3.7 Electrification

Since the pre-independence era, the Nigerian power supply system has been encumbered by the geographical concentration of generation facilities in the South-South and the related difficulties innate in the transmission system with high losses and load shedding. It has also been burdened with geographical challenges. Electrical energy has to be carried to smaller towns over long distances and through forests without proper protection – and with a high number of illegal connections and all the attendant problems of billing.

TABLE 3-5: ELECTRIFICATION RATES IN NIGERIA AND SUB-SAHARAN AFRICA

Region	Sub-Saharan Africa	Nigeria
Population without electricity	621 million	93 million
Overall Electrification rate [%]	32	45
Urban Electrification rate [%]	59	55
Rural Electrification rate [%]	16	35

Source: [IEA 2014]

Reasons for lack of electricity access and frequent blackouts in Nigeria are reported in the General Household Survey of 2010/2011. Over 60% of rural households sampled during the survey attributed the reason for a lack of electricity access to frequent blackouts and high connection cost. Unreliability of service was also reported as one of the reasons for lack of electricity in Nigeria [NBS; 2010/11].

Rural electrification (including off-grid generation), its market, stakeholders and support mechanisms are further dealt with in Chapter 8.

According to the latest available data (cf. Table 3 – 5) the overall electrification rate for Nigeria is just 45 % compared to 32 % average electrification rate in Sub-Saharan Africa. As further detailed in Table 3 – 6 this cannot disguise the fact that there is a sharp discrepancy between cities and rural areas, as the rate of urban electrification in Nigeria is 55 % as compared to only 35 % for rural electrification. Going forward the government plans to achieve an overall electrification rate of 75% by 2025, as emphasized in the "Vision 20:20" and the draft Rural Electrification Strategy and Plan [FMP; 2015].

Table 3 – 6 lists the distribution of households with access to electricity by state. The table shows all households with electricity supply (100%) and the share of the type of supply as a percentage. The table distinguishes between electricity supply by means of PHCN, private generators or solar panels and electricity supply via rural electrification (i.e. mini-grids). As shown in the table, the type of electricity supply varies significantly by state and source. There is a clear North/South divide, possibly attributable to the location of the thermal power stations in the south and the distance involved when wheeling out the power. Figures for those states that have made most progress in rural electrification are marked yellow, while green has been used to highlight states where the reliance on diesel generation was considered exceptionally high. What is also noticeable is that with the exception of a few states, over the period considered, little progress has been made in rural electrification or eliminating reliance on generators – whereby the figures given for generators seem low.

The differences by state can also be read as an indication of market opportunities, since those states where grid-electrification is lowest, or where reliance on PHCN is lowest, are those states where there is the greatest need and therefore, by definition, the greatest potential for investments in rural electrification.

The same source reveals that most rural areas do not have their own generators. In other words, rural electrification was until 2010 at any rate largely left to the informal market, is neither regulated nor structured in a planned manner.

TABLE 3-6:
DISTRIBUTION OF HOUSEHOLDS WITH ACCESS TO ELECTRICITY BY TYPE OF ELECTRICITY SUPPLY IN %, 2010

State	PHCN (NEPA) only	Rural Electrification*	Private Generator	PHCN / Generator	Rural Electricity / Generator	Solar Panel
Abia	89.6	0.9	0.5	5.0	4.1	0.0
Adamawa	89.5	2.9	1.9	4.8	1.0	0.0
Akwa Ibom	82.8	0.4	2.9	13.1	0.8	0.0
Anambra	81.0	1.7	1.0	15.6	0.7	0.0
Bauchi	77.5	8.0	1.4	9.4	3.6	0.0
Bayelsa	33.1	36.1	2.3	2.3	26.3	0.0
Benue	68.5	14.4	2.7	10.8	3.6	0.0
Borno	87.9	6.1	0.0	6.1	0.0	0.0
Cross River	91.7	6.2	0.5	1.6	0.0	0.0
Delta	93.6	2.7	1.5	1.5	0.8	0.0
Ebonyi	78.9	12.7	0.0	1.4	7.0	0.0
Edo	93.1	2.1	1.2	2.7	0.9	0.0
Ekiti	91.1	1.0	0.8	6.9	0.3	0.0
Enugu	75.0	16.9	1.3	5.9	0.8	0.0
Gombe	94.7	3.2	0.0	2.1	0.0	0.0
Imo	85.4	5.0	2.1	7.5	0.0	0.0
Jigawa	93.2	0.9	0.0	4.3	0.9	0.9
Kaduna	84.8	5.1	2.0	7.6	0.5	0.0
Kano	87.0	6.0	0.0	4.0	3.0	0.0
Katsina	80.4	14.7	0.0	4.3	0.0	0.6
Kebbi	86.4	1.6	3.8	7.1	1.1	0.0
Kogi	79.2	3.3	0.4	15.8	1.3	0.0
Kwara	92.8	1.8	0.3	2.4	2.7	0.0
Lagos	67.9	1.2	1.2	25.9	3.5	0.2
Nasarawa	76.0	0.6	7.2	13.2	3.0	0.0
Niger	75.2	1.8	0.9	21.7	0.0	0.4
Ogun	94.5	0.3	0.0	5.2	0.0	0.0
Ondo	87.5	0.8	2.9	2.9	5.8	0.0
Osun	90.5	0.0	0.4	7.1	2.0	0.0
Oyo	97.7	0.9	0.5	0.9	0.0	0.0
Plateau	92.5	1.3	1.3	3.8	1.3	0.0
Rivers	66.0	26.3	6.7	1.0	0.0	0.0
Sokoto	90.4	6.6	0.6	1.8	0.6	0.0
Taraba	85.7	0.0	0.0	14.3	0.0	0.0
Yobe	77.0	6.9	1.1	11.5	3.4	0.0
Zamfara	87.0	6.9	0.0	3.8	1.5	0.8
FCT Abuja	67.4	0.9	1.9	27.6	2.2	0.0
Sector						
Urban	83.2	2.7	0.8	11.3	2.1	0.0
Rural	81.5	7.5	2.0	6.2	2.6	0.1
National	82.2	5.5	1.5	8.4	2.4	0.1

Source: National Bureau of Statistics, 2014

* Rural electrification: Electricity supply via mini-grid, which is not connected with a distribution grid or the transmission grid

3.8 Energy Prices

Nigeria has administratively set maximum prices for kerosene and gasoline and an indicative price for diesel (cf. Table 3 – 7). At the core of this system, which was established in 2003, is the Petroleum Products Pricing Regulatory Agency, which sets these prices every month. The agency applies import parity but is also expected to stabilise prices, which it does with the help of the Petroleum Support Fund (PSF). Consumer subsidies exist for three energy products: gasoline (premium motor spirit, PMS), household kerosene (hhK) and electricity.

3.8.1 Fuel Prices

Crude oil is a globally traded commodity, denominated usually in US dollars; for the purposes of this study, to avoid exchange-rate distortions, quotations will be kept in that currency. Demand for oil is pegged to global macroeconomic conditions and this influences international oil prices. Natural gas prices are less dependent on global trends as there is no world market for gas. Natural gas is traded on more than one regional market with different prices. In the USA, Canada, Great Britain and Japan the price for gas is determined on spot markets. In continental Europe the price of gas is determined by long-term supply contracts with fixed prices. Newly emerging markets for natural gas are China and India, with the Japanese market having changed significantly post-Fukushima and the US market being emphatically altered by the introduction of fracking as a means of tapping in-country gas reserves.

Export prices for Nigerian crude oil correlate with the international market trends. The price has climbed consistently over time, bar the signals seen in crisis years. The US free on board (FOB) price for Nigerian crude oil has risen since 1973 from US$ 7.81 to an initial peak of US$ 38.10 in the 1980's, before steadily climbing since 2001, when the price was US$ 24.85 upward to as much as US$ 114.51 in 2012 [IEA; 2013]. However, between July 2014 and January 2015 the oil price dropped massively from US$ 115 to US$ 45 per barrel, which resulted in a ~28 % drop of Nigeria's revenue (based on Nigeria's gross receipts) [76]. The loss in revenue could only partly be compensated with the reduced government's bills on subsidy (see next paragraph for further details on this).

In the case of petroleum products, the government requires marketers to sell fuel at below market rates. Subsequently paying the difference to petroleum product marketers and licensed importers of fuel. The development of energy prices in the near and distant future depends on political decisions, private investment in the energy sector and world market prices. Realistic figures on the development of prices in the energy sector cannot be given at the moment.

Diesel prices have been deregulated for several years. Government removed the gasoline subsidy on Jan 1, 2012 and allowed the retail price to rise above NGN 140 (US$ 0.88)/ litre or higher. As shown in Table 3 – 7, the fuel subsidy still accounts for a substantial share of GDP and in absolute terms has risen by a factor of seven over the six years covered by the table.

The massive decrease of crude oil prices between July 2014 and January 2015 led to a comparable drop of refined oil prices. According to an article from "This Day Live", at a crude oil price of $115 per barrel, the expected market price of imported petrol is NGN 141 (US$ 0.88) per litre, while the regulated price is NGN 97 (US$ 0.61), translating to a difference of NGN 44 (US$ 0.28) as subsidy. But with the price drop of crude oil to US$ 59.45 per barrel, the government's subsidy spending has been reduced, which led government to lower the regulated price to NGN 97 (US$ 0.61) per litre. [78]

TABLE 3-7:
DEVELOPMENTS IN FUEL PRICES AND FUEL SUBSIDIES, 2006-2012

	2006	2007	2008	2009	2010	2011	2012
Fuel subsidy (bln Naira)	251	290	637	399	797	1,761	1,570
Fuel subsidy (% of GDP)	1.3	1.4	2.6	1.3	2.3	4.7	3.6
Fuel Prices (Naira per litre)							
• Diesel (deregulated)	81	90	118	94	112	152	144
• Kerosene (subsidised)	50	50	50	50	50	50	50
• Gasoline (subsidised)	65	70	70	65	65	65	97

Sources: Nigerian authorities and IMF staff calculations and projections
Note: For 2012, includes one-off payment of about 1% of GDP to settle arrears accrued in 2011.

Gas shortages have been cited by the government as major hindrance to realising the planned power generation. The industry ascribes the shortage of gas for domestic consumption, especially for gas-fuelled IPP's, mainly to the low domestic gas prices compared to the export market and pending approval of the Petroleum Industry Bill (PIB). Although the International Oil Companies (IOC) in Nigeria have an obligation to provide a prescribed percentage of total gas production for domestic consumption this has never materialised, due to the unattractiveness of the domestic market. There are various reasons for the latter, such as poor gas pipeline assets and infrastructure, misaligned funding incentives, theft and vandalism. In August 2014, the Minister of Petroleum Resources announced an upward revision of the gas price from US$1.50 per million cubic feet (mcf) to US$2.50 per mcf, and an additional US$0.80 fee for transport costs (up from US$ 0.30). Such an increase in the gas price may make the national market more attractive for IOCs.

3.8.2 On-Grid Electricity Prices

Since the privatisation process kicked in, electricity prices have been set centrally by the Nigerian Electricity Regulatory Commission in line with its Multi-Year Tariff Order (MYTO). Within the electricity system, DISCOs pay NBET for the electricity they receive from the GENCOs. NBET then pays the GENCOS for the bulk power sent to the grid. Respective prices are fixed per fuel source. For example, the wholesale contract price for a gas power plant is in the order of NGN 10,257 (US$ 64.10) /MWh (2013), whereas the wholesale prices for hydropower, wind, solar and biomass range between NGN 25,400 (US$ 158.75) for hydropower and NGN 73,300 (US$ 458.13) / MWh (2013) for solar PV. On the other hand consumers pay DISCOs for the electricity they consume. Here, prices are fixed per region and consumer category. The price to be paid by the end consumer for electricity in Nigeria is therefore not to be confused with the price paid to the GENCO. This is further detailed in Chapter 4.3.

The MYTO methodology combines the positive attributes of regulating the rate of return and a price cap, which changes by region and type of electricity customer. The regulators factor three modules into the calculation: the allowed return on investment (RoI), the allowed return of capital, and efficient operating costs and overheads. Since the costs factored into the prices are assessed individually for power generation, transmission, distribution and retail, rates differ.

In each instance, in an effort to attract investment in the sector, MYTO emphasises cost recovery and financial viability, whereby the intention is to encourage efficient investments. The multi-year structure provides investors with a firmer basis for planning. Likewise, the tariffs foster an efficient use of the network, as tariffs are destined to reflect the marginal costs users place on the system and boost grid efficiency.

Worthy of mentioning is the tariff design NERC has implemented for DISCOs. It is intended to ensure that a distinction is made between private, commercial and industrial users in regard to electricity prices, while enabling DISCOs to remain commercially viable. Each DISCO has tariffs reflecting its uniqueness in terms of cost, location and customer profile. The Ministry of Finance has provided a maximum subsidy of NGN 50 billion (US$ 312.5 million) (2012 + 2013) solely for residential customers. Moreover, NERC has retained a lifeline tariff at NGN 4.00 (US$ 0.025) / kWh for all those consuming below 50 kWh / month. Cross subsidies from large residential (category R), commercial (category C) and industrial (category D) customers to small residential customers are implicit in the tariff design because the Federal Government subsidy is not sufficient. See [NERC; May 2012] and Table A – 9 in Annex 3.

At present, DISCOs' bills to consumers are made up of two elements: a fixed charge and an energy charge. The former covers capital costs as well as the fixed costs of operation and maintenance across the industry. The latter is charged only when electricity is actually consumed and is intended to cover fuel costs, variable operation and maintenance costs and tax costs to market participants. For example, according to the amended MYTO 2.1 [NERC; Mar 2015], energy charges for residential usage[12] range between NGN 14.96 and NGN 20.89 (US$ 0.094 – 0.131) /kWh with fix charges ranging between NGN 625 and NGN 800 (US$ 3.91 – 5.00) / month, depending on the region (DISCO). As already mentioned, these ranges differ for other types of consumers. For an exhaustive list of the different sub-categories of the main classes (residential, commercial, industrial, special, and street lighting) please see Annex 3, Table A – 9; for the full tariff schedule of two selected DSICOs see Table A – 10.

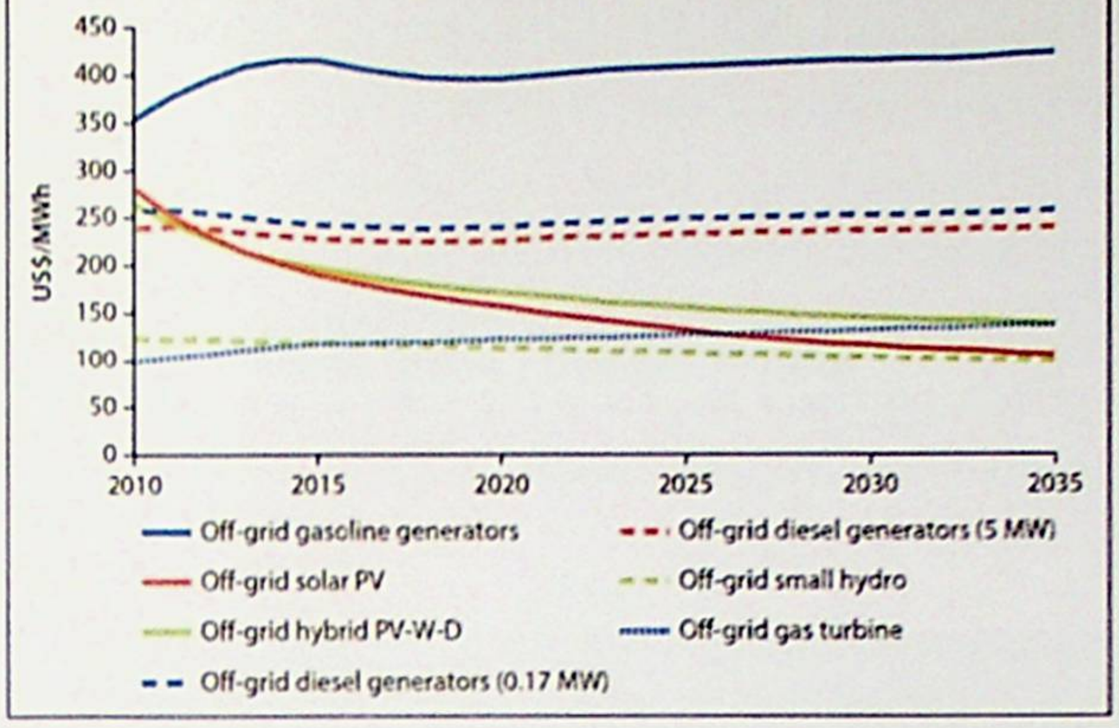
At present, the individual DISCO business plans indicate that aggregate technical, commercial and collection (ATC&C) losses over a five-year period for the distribution companies are assumed to be between 35 – 40%, while technical and commercial losses alone range between 12.0% and 28.4%. The various DISCOs have committed to lower that figure markedly [WB; 2014]. The technical and commercial losses are also factored into the amended MYTO 2.1 conditions for DISCOs, with losses as a percentage of distributed energy being expected to fall. With the introduction of MYTO 2.1 in December 2014, prices for electricity increased by about 80%. Petitions by various consumer groups, evoked by this electricity price increase, led to amendment of MYTO 2.1 and a price drop of ~50%. According to NERC, the main reason for the dramatic price increase was that the collection losses was passed on to the consumers. In the amended MYTO 2.1 NERC considers, "in the public interest and fairness, the level of Collections Losses (amount billed but not collected by the DISCOs) as imprudent to be passed on to consumers since it is fully within the control of the DISCOs to collect their bills. Therefore, for the purpose of the level of loss allowable to pass through to consumers, the Collection Loss has been set at zero ..." [NERC; Mar 2015].

3.8.3 Off-Grid Electricity Prices

The projected prices for off-grid electricity can be seen in Figure 3 – 11 [76]. In the present set-up of the Nigerian electricity market, off-grid generation based on medium-sized diesel gensets is by nature far more expensive for the consumer than on-grid supply of electricity. The World Bank estimates the cost for generation with medium-sized diesel gensets at approx. 250 US$/MWh (corresponds to NGN 40 (US$ 0.25) / kWh). This is significantly higher than the electricity charges for residential usage[13] and also higher than electricity charges of NGN 19.89 – NGN 29.58 (US$ 0.124 – 0.185) /kWh for industrial usage[14], purchased from the DISCOs based on MYTO 2.1 [NERC; Mar 2015]. Small scale businesses and families spend an average of NGN 3.5 trillion (US$ 21.8 billion) yearly to power their generating sets with diesel and petrol due to unstable supply of electricity [65].

[12] Category R2, single phase and 3 phase
[13] See above
[14] Category D1, single phase and 3 phase

FIGURE 3 – 11:
OFF-GRID ELECTRICITY PRICES



Sources: ESMAP 2007; IEA 2010a

The striking element in Figure 3 – 11 is the clear projected decrease in the price of electricity generated by solar PV, which is expected to fall to a level similar to that for small hydropower plants, with the cost of diesel/solar hybrid systems falling by equal scale.

Notably, to date solar PV is already substantially cheaper than electricity produced using diesel generating sets. This especially is the case in areas a long distance from diesel depots – which includes most of northern Nigeria. This trend seems to be persistent, considering various international predictions of the PV prices in comparison to other means of power generation. As shown in Chapter 3.8.1, fossil fuel prices particularly in Nigeria are expected to rise more than in other (comparable) economies, due to expected cuts in subsidies. Taking this into consideration, solar PV plants broke even with diesel generating set much earlier than predicted in the Energy Sector Management Assistance Program (ESMAP) 2007 study. Solar PV/diesel hybrid systems can thus be expected to gain sway over time.

3.9 Transmission and Distribution Sector

The privatisation exercise of NEPA was concluded by the Bureau of Public Enterprises (BPE) and the Bureau of Public Procurement (BPP) in 2013 – 2014 by unbundling the successor companies into 11 distribution companies and 6 generation companies, cf. Chapter 3.4. The Government only retained control of the transmission and system operation under the Transmission Company of Nigeria (TCN). The transmission lines and generators are interconnected in a common grid, with a single control centre at Oshogbo. Thus, the government bears the cost of high voltage grid expansion and encourages private investors to focus on generating capacity. Distribution companies are responsible for the expansion of medium and low voltage distribution grids.

3.9.1 Transmission

The National Grid operates at 330 kV and 132 kV high voltage level (HV). In 2010, more than 12,300 km of transmission lines (5,523 km of 330 kV and 6,801 km of 132 kV) connecting 32 330 kV and 105 132 KV substations were operational. At the current configuration (2014) the national grid has an installed capacity of 6,500 MW but can handle a wheeling capacity of maximum 4,500 MW [Dagogo-Jack, R. B.; 2014]. The ongoing NIPP transmission projects will further boost the wheeling capacity by 1,300 MW. The long-term planning of TCN is to further improve the grid capacity – thereby topping the installed generation capacity – to 10 GW by 2014, 16 GW by 2017 and 20 GW by 2020 as further detailed in Figure 3 – 12, Figure 3 – 13 and Figure 3 – 14. However, by April 2015, the proposed system enhancements shown in Figure 3 – 13 are under construction but not yet completed.

The Nigerian national grid is characterised by the poor voltage profile in the network (especially in the north due to its radial nature) and is constrained by limited control infrastructure. Overloaded transmission lines and high

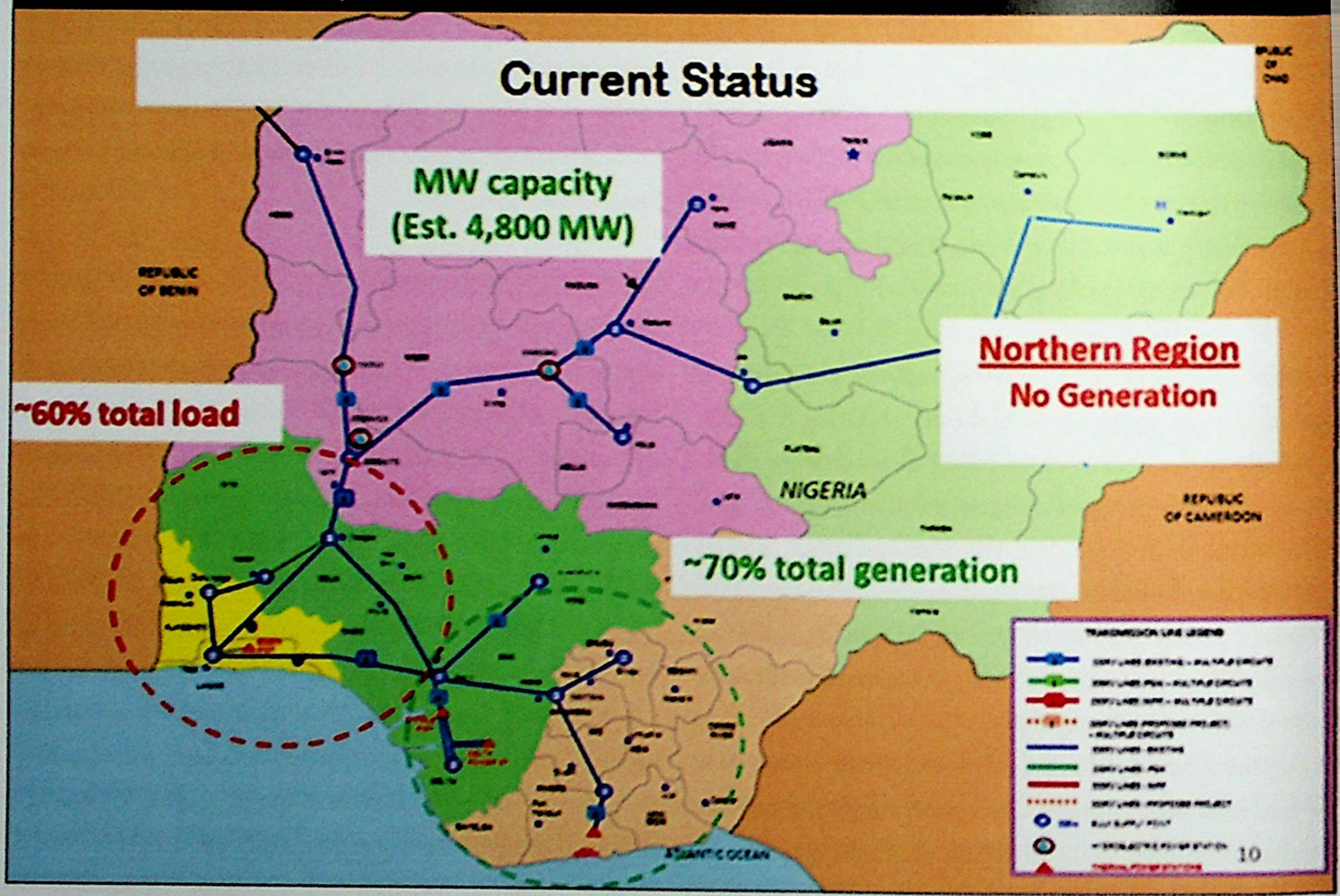
technical and non-technical losses are a regular feature. [NERC; Feb 2011]. Transmission and distribution losses combined are estimated at 17 – 20% [15]. The first 15 months after privatization saw 20 system collapses.

As per the Amended MYTO 2.1, he current wheeling charges ("TCN Tariff") amount to NGN 2 743 (US$ 17.14) per MWh.

There are 3 key issues facing the improvement in the na tional grid.

- Establishing a clear plan for operational enhancement to reduce technical and commercial losses.
- Full market integration of TCN in order to operate as credit-worthy industry participant.
- A comprehensive assessment and clean-up of TCN's project portfolio to enable the completion of several ongoing and stranded projects.

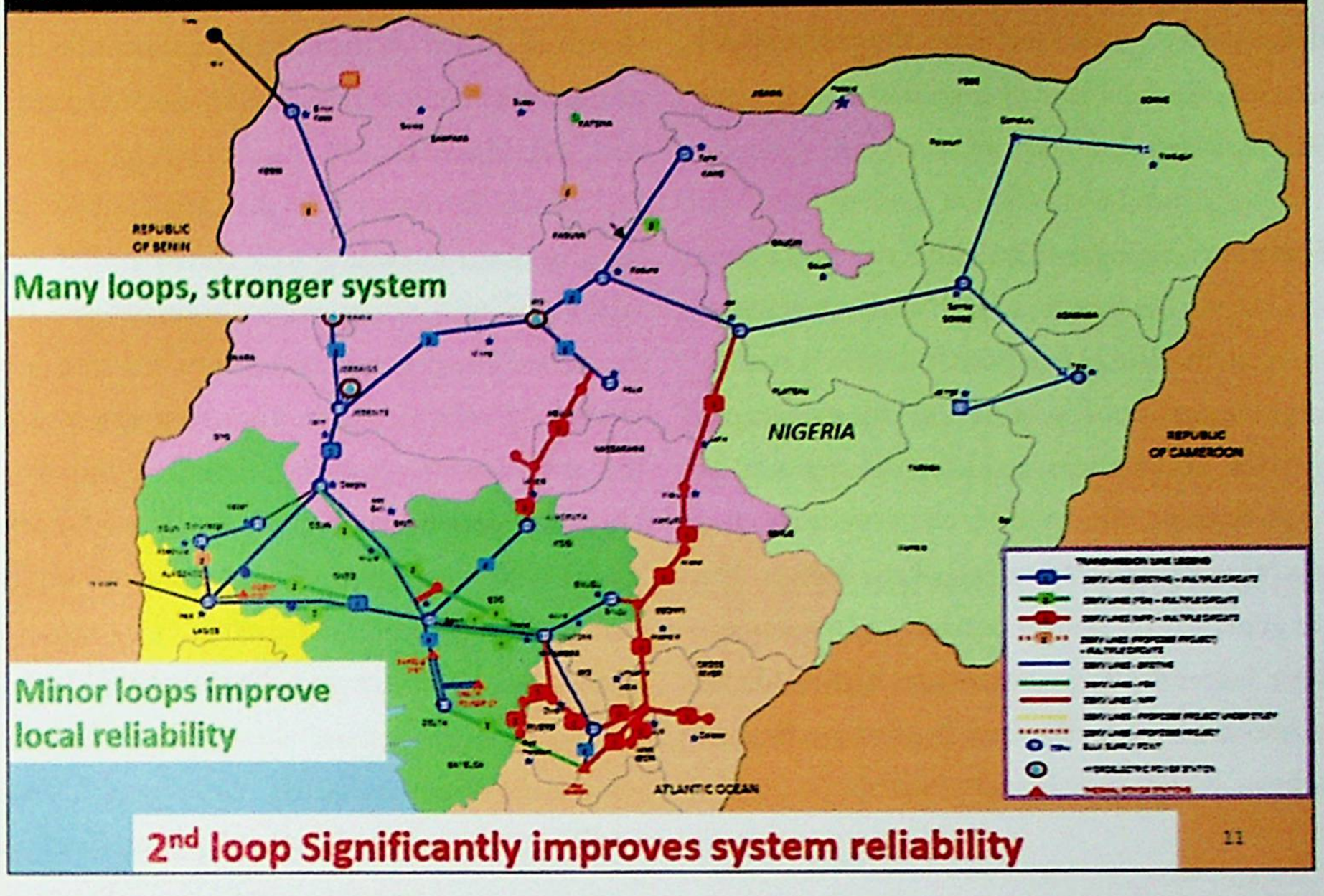
FIGURE 3 – 12:
EXISTING 330 KV RADIAL GRID, 2013



Source: [TCN; 2013]

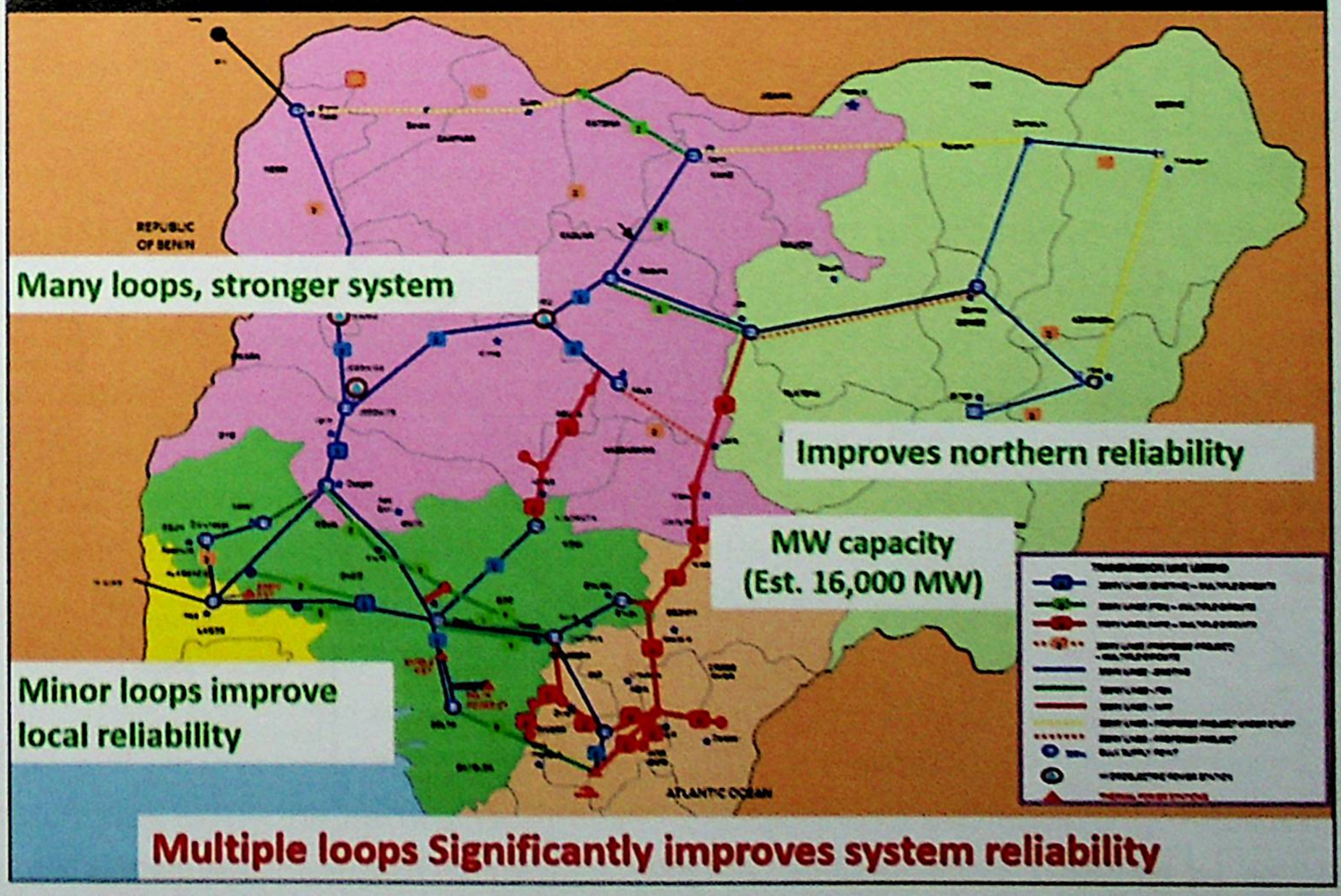
[15] TCN archive (supported by NIAF)

FIGURE 3 – 13:
330 KV TRANSMISSION GRID FOR WHEELING 10,000 MW, END OF 2014



Source: [TCN; 2013]

FIGURE 3 – 14:
330 KV TRANSMISSION GRID FOR WHEELING 16,000 MW, END OF 2017



Source: [TCN; 2013]

3.9.2 Distribution

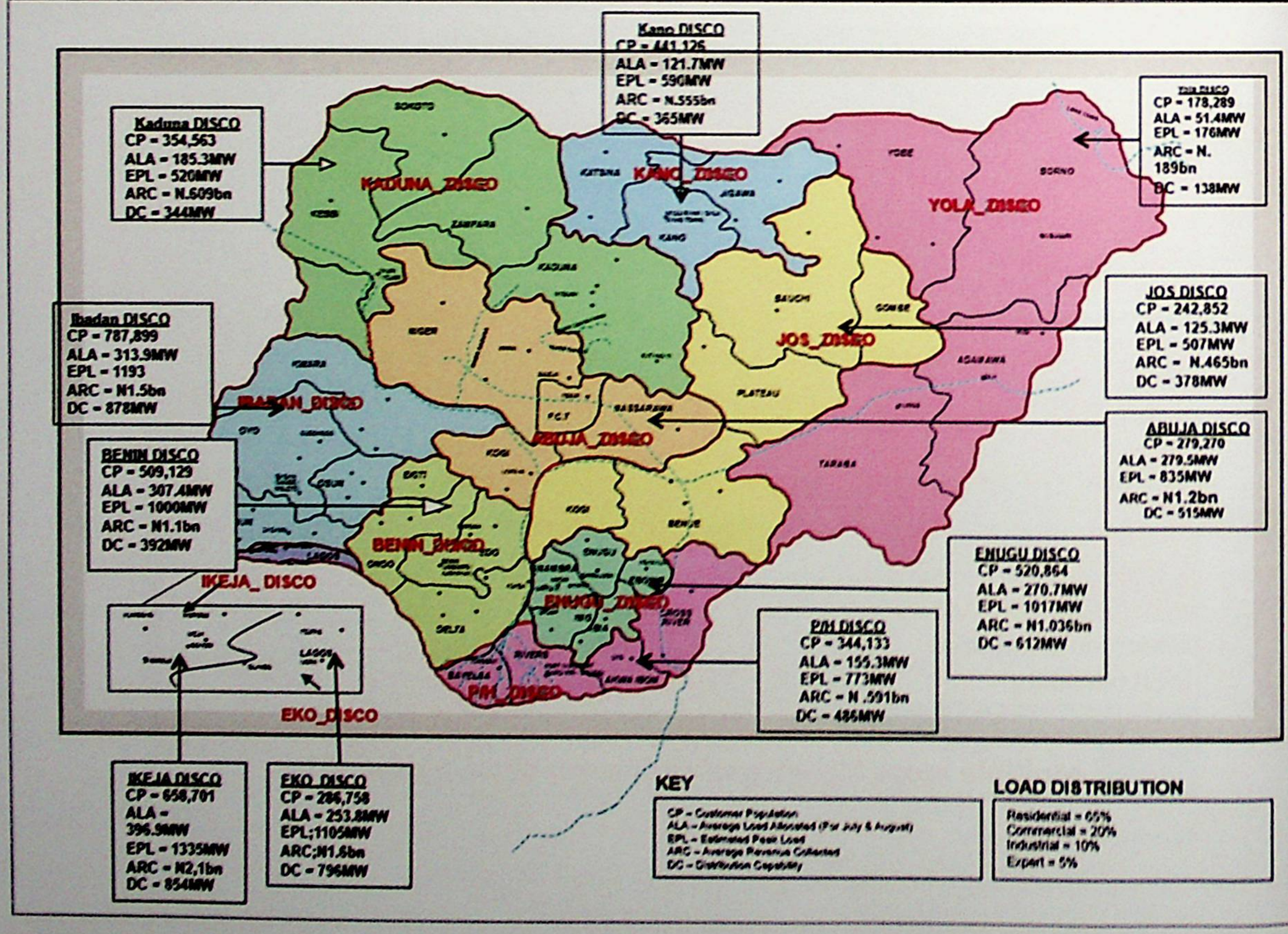
The distribution grid operates mainly on 33 kV and 11 kV level, i.e. medium voltage (MV) and low voltage level (LV). In 2010 more than 24,000 km of distribution network were available [NERC; Feb 2011].

Figure 3 – 15 shows the geographical areas covered by the respective distribution companies as well as the mega-wattage allocated to them. The north/south divide is readily apparent from the ratio of population to megawatts, whereby within the north there is a sharp discrepancy between the mega-wattage allocated to the northeast, and that to the central and western sections of the region. The companies are generally owned by consortia. In some cases these include larger state governments. The 11 distribution companies are: Abuja, Benin, Eko, Enugu, Ibadan, Ikeja, Jos, Kaduna, Kano, Port Harcourt, Yola.

During the privatisation process preferred bidders were identified, based on the determination "of the most aggressive but feasible loss reduction trajectory over a 5 year period" [NERC; Mar 2015].

The distribution code innate in the power sector privatisation policy is not specific about off-grid or mini-grid networks. The general assumption is that it does not apply to them, giving a greater scope to investors in such areas. The distribution code is further detailed in Chapter 5.5.1.2. Independent Electricity Distribution Networks (IEDNs) represent an efficient way of supplying areas with electricity which are not connected to the national grid or a distribution grid [Detail; 2012].

FIGURE 3 – 15:
THE DISTRIBUTION COMPANIES´ MARKETS



Source: Securities & Exchange Commission, Nigeria, [53]

With the privatisation of the power sector, the composition of its stakeholders has changed markedly. From the inception of the interim market onwards, the main stakeholders in the sector are and will be private entities, with government retaining the role of regulator and grid operator only. The World Bank still acts to provide the Federal Government with a partial risk guarantee to cover possible defaults in the system in the event of NBET not being able to pay a generating company during the lifetime of the interim market [African Development Fund; 2013]. Public-sector players still active in the market tend to be those states that have acquired or are acquiring shares either in distribution companies or in independent power plants. NGOs and international donor organisations' activities are mainly focused on supporting policy-making, energy efficiency and renewable energy projects. Development Finance Institutions (DFIs) are involved in various cases in debt financing for larger power plants. With the restructuring of TCN there is renewed participation by DFIs in transmission sector upgrades and expansion.

Because of the hitherto non-commercial nature of the sector, activities by public institutions have tended to be the primary driver of rural electrification (RrE), energy efficiency (EE) and renewable energy (RE) initiatives in Nigeria to date. Until October 2013 the Federal Government of Nigeria had the largest stake in the energy and power sector of the country, thus making private investor involvement limited and also posing the challenge to policymakers to create an investor-friendly climate in a domain not known for its short-term commercial viability. The role of regional and international institutions on the other hand is based on developmental needs and strictly non-commercial. For details on the privatisation process see Chapter 3.

A key advantage of the present structure is that it enables the federal government to take the lead in pursuing clean technologies and promoting a diversified electricity mix. Given the paucity of the power sector per se, Nigeria can potentially avoid the pitfalls industrialised nations faced when fast-tracking the use of renewables. Nevertheless, the distribution and the generation companies will play as important a role as the central government does. The current institutional arrangements are discussed in detail in a study published by GIZ in November 2013 and entitled "Institutional and Policy Mapping of the Renewable Energy, Energy Efficiency and Rural Electrification Subsectors in Nigeria". [GIZ; Oct 2013].

The present chapter will provide a concise synopsis of the major actors in the Nigerian energy sector.

4.1 National Public Institutions

The following chapters summarise the major national public institutions active in the energy market. Stakeholders will also be mentioned in Chapters 6, 7 and 8 whenever applicable.

4.1.1 Federal Ministry of Power

The liberalization of the power market has resulted in a change in the needs of the sector. As a consequence, the Federal Ministry of Power (FMP) is now undergoing a restructuring process that will allow it to adapt to the new environment. In this context, a new department entitled "Renewable and Rural Power Access" was created.

The FMP is responsible for ensuring the establishment of a robust power sector that fully supports the socio-economic needs of the nation. The main goal of the FMP is directed at initiating, formulating, coordinating and implementing broad policies and programmes promoting the development of electricity generation from all sources of energy.

The Honourable Minister of Power heads the Ministry, while the Honourable Minister of State is in charge of the operational activities, and the Permanent Secretary is the accounting officer. The latter two offices are supported by seven departments and five units. They are responsible for the promotion of all forms of electricity generat-

ed from both renewable energy and other non-renewable energy sources. In order to facilitate diversification of the nation's energy mix, the ministry is encouraging the use of renewable energy sources for power generation, especially in rural areas of the country. The ministry convenes the Inter-Ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE), has commissioned some solar power pilot projects in Ogun and Cross River states, and is building a pilot wind farm in Katsina. [11] The REA, EMSL and NAPTIN are affiliated to the FMP, whereby the ministry oversees the independent regulator NERC (see below).

4.1.1.1 Nigerian Electricity Regulatory Commission (NERC)

The Nigerian Electricity Regulatory Commission (NERC) was established as an independent regulatory agency in 2005 under the EPSR Act 2005. Its mandate is to monitor and regulate the electricity industry of Nigeria, and ensure compliance with market rules and operating guidelines.

NERC in its function as market regulator shall ensure fair and competitive electricity trading. It is instrumental in providing a 15-year tariff path which undergoes major reviews every six years with minor reviews biannually. As part of its mandate NERC has at present set the Multi Year Tariff Order (MYTO 2.1) which defines generation and consumer offtake prices.

Moreover, and crucially, NERC is responsible for assessing applications for licenses to operate an independent power plant larger than 1 MW, and thus approves eligibility of the company in question to negotiate a power purchase agreement with the central off-taker in the current transitional market, the Nigerian Bulk Electricity Trading Plc (NBET).

In order to create an enabling investment climate for rural electrification projects, NERC is currently elaborating regulatory guidelines for mini-grids less than 100 kW and a light-handed regulation for mini-grids between 100 kW und 1 MW.

The commission also plays a key role in consumer protection by developing customer service standards and fair pricing rules. NERC also provides effective dispute resolution mechanisms.

4.1.1.2 Rural Electrification Agency of Nigeria (REA)

Nigeria's Rural Electrification Programme was launched in 1981 aiming at connecting all local government headquarters and selected neighbouring towns and villages to the national grid. The Federal Ministry of Power and Steel in collaboration with the Power Holding Company of Nigeria (PHCN) handled the rural electrification activities centred on grid extensions. They were substituted by the Rural Electrification Agency (REA), which was established in 2006 as part of the Electric Power Sector Reform Act (EPSRA).

REA's core function is to coordinate rural electrification activities in Nigeria and to manage the Rural Electrification Fund. Until recently, the REA has been implementing electrification projects on its own with a focus on grid extension. Most recently the agency has broadened its scope to include the deployment of off-grid renewable energy systems to accelerate the pace of improvement. [Montgomery, E.; 2012]

The REA provides overall support and coordination of rural electrification activities of various stakeholders such as public -private partnerships, private investors and community owned/operated projects. REA through its offices in each of the six geopolitical zones conducts feasibility surveys, market surveys, and willingness to pay surveys to ensure easy offtake. The REF Management Directorate of the REA is responsible for establishing and administering the Rural Electrification Fund to provide capital subsidies in a clear and transparent competitive process, to qualified rural electrification schemes developed by public and private sector entities.

Since 2013, REA's role is transitioning from centrally managed and government-funded projects, towards a demand-driven (yet still centrally coordinated) market approach. The REA does not have any regulatory mandate.

4.1.1.3 Electricity Management Services Limited (EMSL) of Nigeria

The Electricity Management Services Limited (EMSL) of Nigeria is a governmental agency under the FMP providing support services to the electricity generation, transmission and distribution sector in Nigeria. It is set up to guarantee efficient and reliable production and delivery of power as well as the safety of lives and property in the electricity sector.

EMSL inspects, tests and certifies electrical materials, equipment, power systems and electrical installations of the Nigerian power industry. Installations are tested for their adherence to technical standards and regulations.

Furthermore, EMSL provides advanced trainings for technicians as well as licensing of technical personnel.

After the imminent adoption of the NEMSA Act, EMSL will be renamed into Nigerian Electricity Management Services Agency (NEMSA).

4.1.1.4 National Power Training Institute of Nigeria (NAPTIN)

As a response to the massive training needs in the power sector, the National Power Training Institute of Nigeria (NAPTIN) was established in March 2009. NAPTIN directly reports to the FMP and operates from its headquarter in Abuja eight regional training centres in Afam, Akangba, Ijora, Jos, Kaduna, Kainji, Kano and Oji.

So far, NAPTIN has focused on government-funded technician training courses. Flagship programmes include the National Graduate Skill Development Programme (NGSDP) and the National Power Sector Apprenticeship Scheme (NAPSAS), the latter aiming to train 7 400 graduates in a broad range of technical power professions.

In order to maintain its position as a one-stop-shop training institute for the privatized power sector, NAPTIN increasingly intends to adopt a private-sector driven approach in its operations.

4.1.2 Federal Ministry of Environment (FMENV)

The Federal Ministry of Environment (FMENV) was established in 1999 with the statutory responsibility of protecting the environment against pollution and degradation and to ensure the conservation of natural resources for sustainable development in Nigeria. FMENV is also charged with coordinating all climate change matters under its Department Of Climate Change. The department represents the Ministry at international climate negotiations.

The Department Of Climate Change follows the objective to foster renewable energy and energy efficiency. It thereby mainly focuses on the sustainable use of biomass for cooking purposes and small scale agricultural applications.

The FMENV is also the regulator for the Environmental and Social Impact Assessment (ESIA). ESIA are mandatory for all development projects as per the Nigerian EIA Act No. 86 of 1992.

Its roles in renewable energy and rural electrification are further detailed in Chapters 6.2 and 7.4, respectively.

4.1.3 Federal Ministry of Science and Technology (FMST)

The Federal Ministry of Science and Technology develop and implements strategies for science and technology development in Nigeria.

The ministry consists of five technical departments, each specialising in a certain field of science and technology: Science and Chemical Technology Department, Renewable and Conventional Energy Technology Department, Technology Acquisition, Adaptation and Promotion Department, Biomedical Science, Health and Environmental Technology Department and Bio resources Department.

The Renewable and Conventional Energy Technology Department is responsible for energy issues in the FMST. The focus lies on nuclear, renewable and alternative energy sources as well as energy efficiency and R&D activities addressing energy-related problems associated with environmental degradation, pollution and climate change. Roadmaps are being designed aiming at further integration of renewable energy into the existing energy mix. Furthermore, the ministry manages energy statistics.

In this function, the FMST also oversees the Energy Commission of Nigeria and the National Agency for Science and Engineering Infrastructure

4.1.3.1 Energy Commission of Nigeria (ECN)

Established in 1988, the Energy Commission of Nigeria (ECN) is "charged with the responsibility for the strategic planning and co-ordination of national policies in the field of energy in all its ramifications" (ECN Act). This includes advisory services to the government on energy strategies, preparation and dissemination of information, promotion of research, development and training, as well as liaising with international energy-related organisations.

Energy research, development and training related activities are carried out in the six technical departments and the six energy research centres. Two of the centres, located at Nsukka and Sokoto, are responsible for new and renewable energy research. The centre in Lagos focuses on energy efficiency and conservation, while the centre in Benin City specialises in energy and environment. The two centres in Ilorin and Bauchi are responsible for hydropower research and research in the area of petroleum respectively.

ECN was instrumental in launching the Renewable Energy Master Plan (2102). Another significant contribution was the preparation of the first National Energy Policy launched in 2003. This policy is currently under revision.

The roles of ECN in the RE, EE and RrE sectors are further outlined in Chapters 6.2, 7.4 and 8.2, respectively.

4.1.3.2 National Agency for Science and Engineering Infrastructure (NASENI)

The federal government has established the National Agency for Science and Engineering Infrastructure (NASENI) in 1992. NASENI promotes local manufacturing of renewable energy technologies such as solar modules, small hydro turbines, pole mounted transformers and wind turbine blades.

4.1.4 Federal Ministry of Lands, Housing and Urban Development (FMLHUD)

The Federal Ministry of Lands, Housing and Urban Development (FMLHUD) aims at providing adequate housing for all Nigerians in a conducive and liveable environment. This includes the design of urban development plans as well as the implementation of public housing programmes. The ministry furthermore is the driver of building-related policies and has the power to enforce regulations in the building sector. It thus plays a strategic role regarding energy efficiency in buildings which it lives up to by e.g. including energy aspects in the ongoing review of the building code (see also Chapter 7). The state ministries of housing can play an equally important role at state level.

The FMLHUD supervises the activities of the Federal Housing Authority (FHA), the Federal Mortgage Bank of Nigeria (FMBN), and the registration boards of the rele-

vant professional bodies. [9] The role of the FMHLUD in promoting Energy Efficiency will be further discussed in Chapter 7.

4.1.5 Federal Ministry of Water Resources (FMWR)

The Federal Ministry of Water Resources (FMWR) was created in its current form in April 2010 with the mission to provide sustainable access to safe and sufficient water to meet the socio-economic needs of all Nigerians through efficient water resources management for basic human needs, irrigated agriculture, hydropower generation and the promotion of a healthy population while maintaining the integrity of fresh water bodies.

Through the Department of Dams and Reservoir Operations, the FMWR is involved in numerous hydropower projects. While the FMWR handles civil works and issues water licenses, the Ministry of Power oversees the power generation aspects of the projects. To date, ministry has carried out studies on some hydropower projects as further detailed in Chapter 6.1.2.

4.1.6 Federal Ministry of Industry, Trade and Investment (FMITI)

The Federal Ministry of Industry, Trade and Investment has the mission to create an economic environment in Nigeria that attracts investments, advances the industrialization process and expands trade and export in order to strengthen the domestic economy.

Among other sectors the FMITI supervises products, processes and companies in the energy industry and supports and enacts renewable energy and energy efficiency measures. It oversees the production of component parts of solar panels and is responsible for policies regarding blending of biomass and provides industry incentives for renewable energy applications.

4.1.6.1 Standards Organisation of Nigeria (SON)

The Standard Organisation of Nigeria (SON) is a federal government entity affiliated to the FMITI tasked with the responsibility of ensuring that all products (imported and manufactured in Nigeria) adhere to stipulated standards.

The functions of the SON include [55]:

- preparing Nigerian Industrial Standards and ensuring the compliance of products and methods with such standards;
- establishing a quality assurance system including certification of factories, products and laboratories;
- fostering interest in the formulation and adherence to standards by industry and the general public
- assessing the conformity of imported products in the port of origin (pre-shipment verification)

The SON has developed and/or adopted some standards on renewable energy and energy efficiency recently. Among these standards are a code of practice for the deployment of outdoor solar lighting, design qualification and type approval of PV modules, safety standards for use of PV power converters, etc. The current list of SON standards is attached hereto in the Annex 4, Table A – 11.

4.1.7 Nigerian Bulk Electricity Trading Plc (NBET)

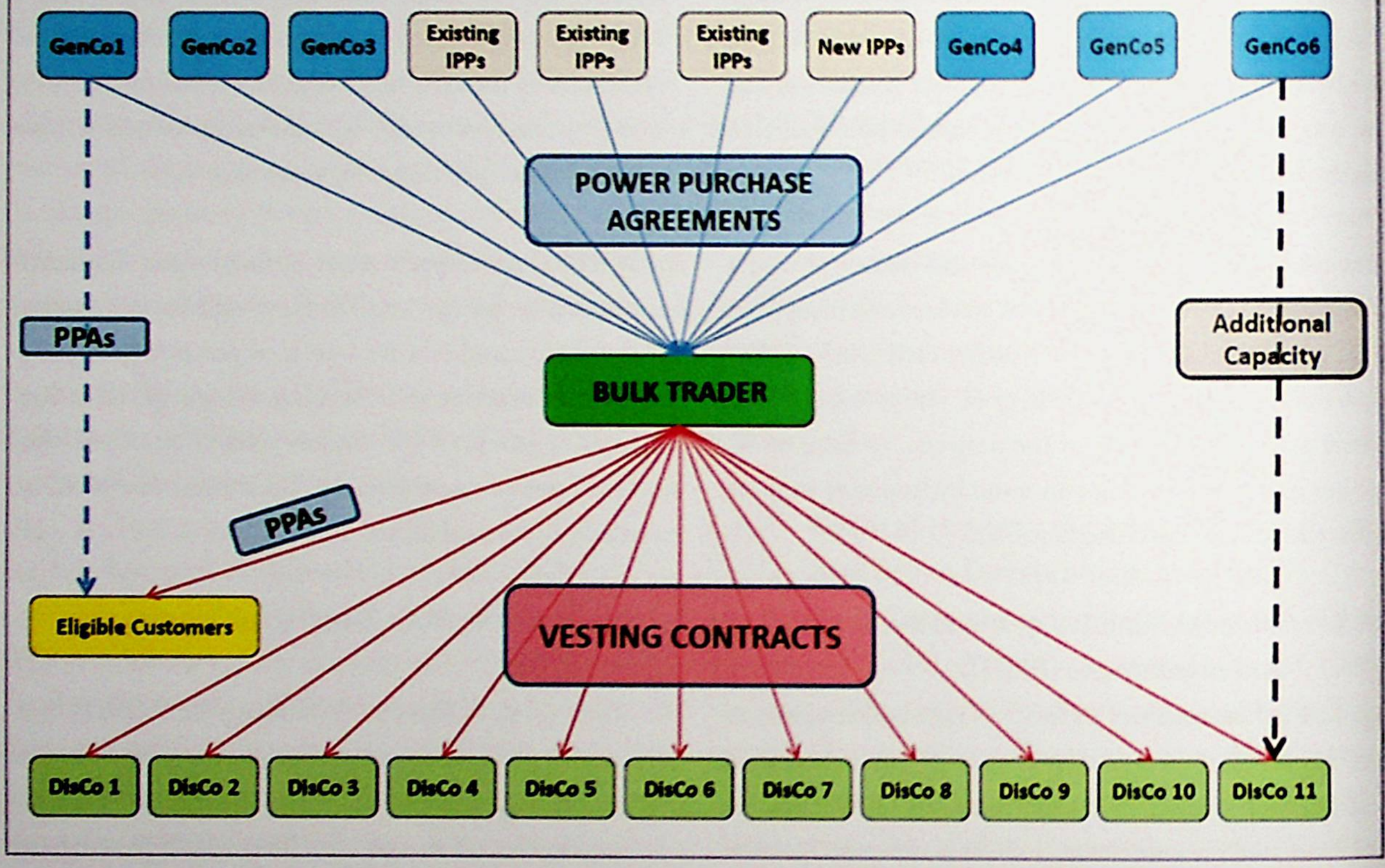
The Nigerian Bulk Electricity Trading Plc (NBET) is a government owned public liability company. The Bureau of Public Enterprises and the Ministry of Finance are its two shareholders of record with 80% and 20% stakes respectively.

NBET was established in 2010 in line with provisions of the Electric Power Sector Reform Act (EPSRA). It is a trading licensee holding a bulk purchase and resale license. Its mandate is to engage in the purchase and resale of electricity and ancillary services from independent power producers and from the successor generation companies.

The transitional market trading arrangement is depicted in Figure 4 – 1. NBET signs PPAs with privatised generation companies, greenfield IPPs and existing state-owned

power plants. They resell power via vesting contracts with distribution companies and sign power sales agreements with eligible customers directly. NBET's power purchase agreements (PPAs) with independent power producers are backed by credit enhancement instruments provided by the FGN.

FIGURE 4 – 1:
NBET, TRANSITIONAL MARKET TRADING ARRANGEMENT



Source: [Wonodi; 2013]

4.1.8 Nigerian National Petroleum Corporation (NNPC)

NNPC has sole responsibility for upstream and downstream developments in the oil industry, and is also responsible for regulating and supervising the sector on behalf of the Nigerian government. NNPC was established in 1977 as a merger of the Nigerian National Oil Corporation and the Federal Ministry of Mines and Steel.

In 1988, the corporation was commercialised into 11 strategic business units, covering the entire spectrum of oil industry operations: exploration and production, gas development, refining, distribution, petrochemicals, engineering, and commercial investments. NNPC by law manages the relation between the Nigerian federal government and a number of foreign multinational corporations. Through collaboration with these companies, the Nigerian government conducts petroleum exploration and production.

Regarding renewable energy and energy efficiency, NNPC explores the use of biofuels (mainly ethanol and biodiesel) for mixing with conventional fuel and seeks to reduce its internal consumption.

4.1.9 Presidential Task Force on Power (PTFP)

The Presidential Task Force on Power (PTFP) was constituted in order to drive the implementation, monitoring and performance evaluation of the power reform agenda. The PTFP's mandate covers the development of the Roadmap and the provision of effective technical support to the sector reform agenda. Furthermore, it acts as interagency interface to ensure that every milestone in the power sector reform roadmap is accomplished.

The Technical Board[16] of the PTFP brings together all the reform project stakeholders that have a role to play in removing legal and regulatory obstacles to private sector investment in the power industry. PTFP also has the mandate to monitor the planning and execution of various short-term projects in generation, transmission, distribution and fuel-to-power which are critical to meeting the service delivery targets in the power sector reform roadmap. [PTFP; 2013]

4.1.10 Nigerian Governor's Forum (NGF)

The Nigeria Governors' Forum (NGF) is an association wielding significant political influence that brings together the governors of the 36 federal states of Nigeria. It aims at promoting a cross-state platform to discuss public policy issues and share experience on good governance. Further, the NGF aims to enhance cooperation at state level. The vision of the NGF is to be a non-partisan forum promoting democratic values, good governance and sustainable development in Nigeria.

4.2 Role and Functions of States and Local Governments

As is the case in other countries, the Nigerian constitution distinguishes between exclusive national, state and local competencies as well as concurrent competencies. Whereas mines, minerals, oil, natural gas and water resources are defined as an exclusive competency of the federal government, power is a concurrent competency shared between the federal and state governments, though the delineation of powers is not clear cut. The federal government has a mandate to regulate power generation and transmission of the national grid. States also have a mandate to engage in power generation, while distribution of electricity seems to be confined to off-grid areas.

Some Nigerian states deduce a mandate for energy and climate out of the concurrent competencies for environment, social and economic development, arguing that energy is a vital and cross-cutting element for the achievement of the constitutional objectives in these three areas of concurrent competencies.

Some states such as Lagos and Rivers are already exploring various models to generate and distribute electricity and are now pushing for an enhancement in their powers so they can become less dependent on the national electricity stem and generate own revenues. With the privatisation of generation companies, states are actively seeking to acquire stakes in DISCOs as investments that offer both a long-term return and foster the prosperity of their inhabitants.

The power sector reform (cf. Chapter 3.4) has affected the distribution of roles between federal level, states and private sector with the states now able to acquire a stakeholder position in DISCOs. The local reach of the DISCOs coupled with the possibility of backing from the state can allow the state to shape the future expansion of the power distribution to closely match its aspirations.

Notwithstanding their constitutional mandate, the states have been engaging in electrification via grid extensions in the past and are likely to continue in the future. A close coordination with the newly established DISCOs will be crucial for a successful grid extension.

---

[16] Engr. Clement A. Oke, FNSE, Acting Chairman
Engr. Simeon Atakulu, Senior Performance Monitor, Generation
Engr. Joe Ajah, Senior Performance Monitor (Acting), Transmission
Engr. Abu Kadiri, Senior Performance Monitor (Acting), Distribution
Engr. Chike Madueke, Senior Performance Monitor, NIPP
Engr. Chidi Ike, Senior Performance Monitor, Market/Efficiency and Renewables
Mr. Azu Obiaya, Senior Performance Monitor, Regulatory and Transactions Monitoring
Mr. Ebipere Clark, Senior Performance Monitor, Program Management Unit
Mrs. Awele Okigbo, Senior Performance Monitor, Media and Communications Unit
Mr. David Tabai – Acting Secretary to the Board
Mallam Salisu Muhammad, Labor Relations Adviser

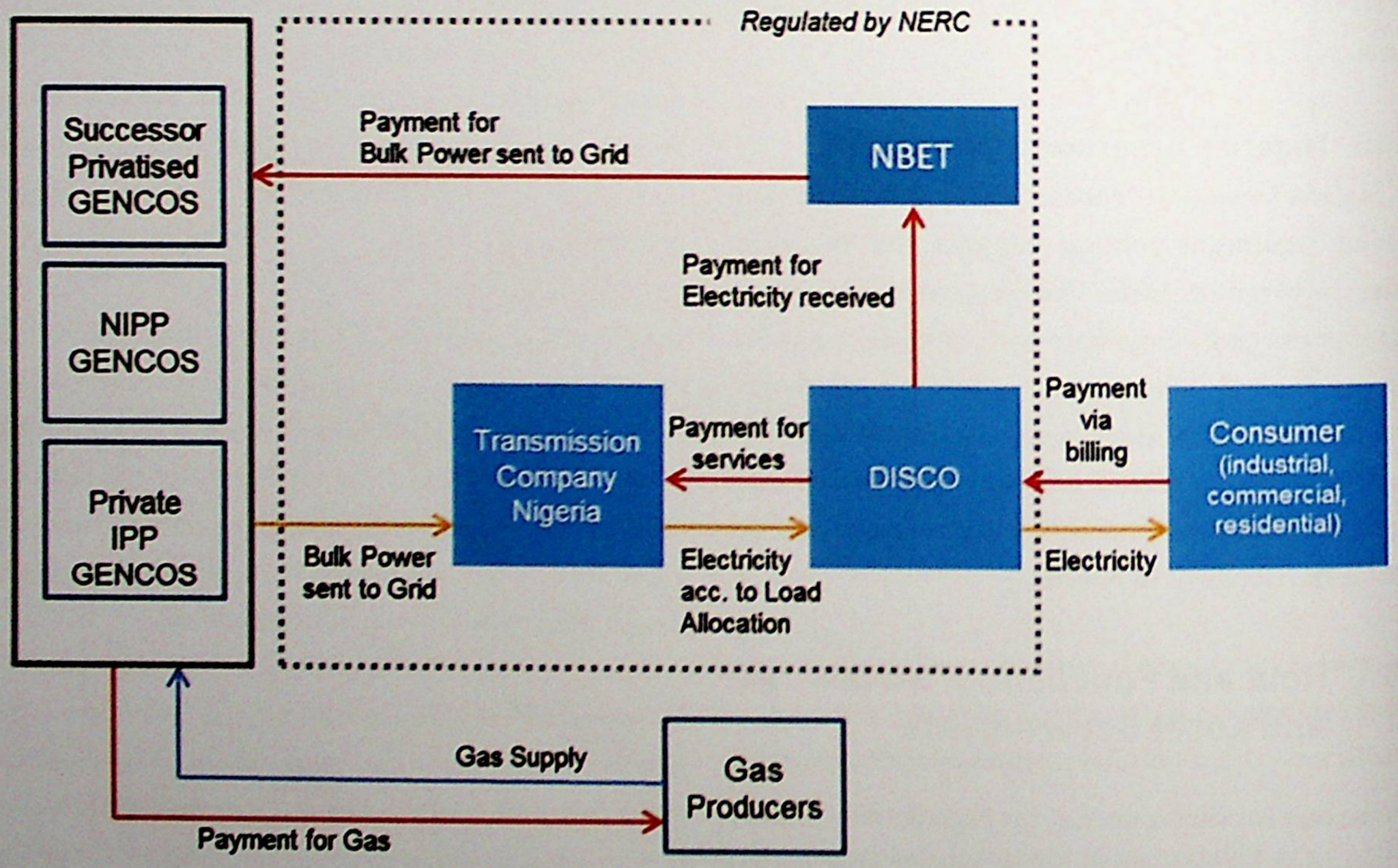
4.3 Market Players in Generation, Transmission and Distribution

The privatisation process (cf. Chapter 3) has introduced competition in the generation of electricity as a key aspect of electricity reform and decentralisation. A central feature of a decentralised electricity market is the wholesale electricity spot market or pool, where generating entities compete to supply energy through their supply prices or bids.

While transmission remains in the hands of government, generation and distribution are now in private hands following lengthy and in part fiercely contested bidding processes. The outcome of the bidding is clear and the process has moved forward, with government generating assets sold and new generating licenses having been awarded. The chart in Figure 4 – 2 describes the roles and responsibilities in the sector post-privatisation:

The electricity produced by various generation companies (GENCOs) is sent to the regional distribution companies via the Transmission Company of Nigeria. The DISCOs sell the electricity received to the industrial, commercial or residential consumers. Consumers in turn pay for the electricity drawn from the distribution network. These payments are forwarded by NBET to the generation companies. TCN is being paid for its services providing the network. The federal government implemented NBET as a bulk trader to compensate for any uncovered payments in the system through subsidies.

FIGURE 4 – 2:
STRUCTURE OF THE POWER SECTOR POST-PRIVATISATION



[Source: GOPA-international Energy Consultants GmbH]

Table 4 – 1 outlines the key players in the interim and transitional market which will be further described in subsequent sections. It will be readily apparent that the composition is still mixed:

In order to speed-up the deployment of new generation capacities, the Nigerian government embarked on the so called National Integrated Power Project (NIPP) programme essentially using government funds to build ten

TABLE 4 – 1:
NIGERIAN POWER SECTOR – KEY INDUSTRY PARTICIPANTS

Key Industry Participant	Description
Power Holding Company of Nigeria (PHCN) Successor Generation Companies	• Nine companies for ten power plants. • Three hydropower plants and seven gas-fired plants. • Total installed capacity of 6,313 MW, of which 3,366 MW available. • Contracts for privatisation concluded
NIPP Generation Companies*	• Ten companies, each owning one gas-fired power plant • Total design capacity at ISO of 5,453 MW. • Five plants with an installed capacity of almost 2,000 MW fully or partially operational.
Independent Power Producers ("IPPs")	• Eight power plants with an installed capacity of 2,127 MW of which 1,320MW available. • Plants use either gas or oil as fuel.
PHCN Successor Distribution Companies	• Eleven distribution companies covering all 36 states and the Federal Capital Territory • Contracts for the privatisation of eleven companies executed
Transmission Company of Nigeria (TCN)	• State entity responsible for the transmission of electricity from power plants to distribution companies, eligible customers and for export • Acts as transmission services provider (TSP), system operator (SO) and market operator (MO) • Managed by Manitoba Hydro International of Canada under a three-year management contract • Separation into an Independent System Operator (ISO) and a Transmission Service Provider (TSP) ongoing
Nigerian Bulk Electricity Trading PLC (NBET)	• Government entity responsible for purchasing electricity from generation companies under long term power purchase agreements and selling it to distribution companies.
Nigeria Electricity Regulatory Commission (NERC)	• Independent agency established to regulate the power sector in Nigeria. • Responsible, inter alia, for the issuance and renewal of generation licenses and the determination of tariffs that sector participants may charge for their products and services.
Gas Aggregation Company of Nigeria (GACN)	• Established in 2010 to manage the implementation of the domestic gas supply obligation regulations. • Acts as the facilitator between suppliers and purchasers of natural gas.
Nigerian Gas Company Limited (NGC)	• One of the subsidiaries of Nigerian National Petroleum Corporation. • Responsible for the transportation of natural gas through its pipeline network.

* These companies are in the process of privatisation.

4.3.1 Generation Companies

Before privatisation, the government-owned generation companies comprised of three hydropower plants and seven thermal power generating stations [30]. As a preparation for the privatization, each entity was incorporated as a single-asset generating company under the rough of the Power Holding Company of Nigeria (PHCN). Because they were originally all government owned, after their privatisation these entities are called "PHCN Successor GENCOs".

gas-fired power plants with the aim of eventually selling them off to private investors. This innovative approach, which however was beset with delays, is described more in detail in the box below.

So called Independent Power Producers are the third form of power utilities and are characterized by the fact that they were and are being developed from the beginning as privately owned greenfield power projects.

See Table 4 – 1 above for information on the number of plants as well as their installed and available capacities for each of the three modalities.

The World Bank and the African Development Bank assist electricity investors with partial risk guarantees[17] with a total project volume of US$ 670 million. These instruments are offered through the International Bank for Reconstruction and Development (IBRD), the International Development Association (IDA) and the Multilateral Investment Guarantee Agency (MIGA)[18]. Partial risk guarantees from IDA and IBRD protect private lenders and/or investors against the risk of a government entity not fulfilling its end of a contract. Partial risk guarantees are suitable for the privatisation of infrastructure assets as in the Nigerian privatisation programme and those provided by MIGA protect investors and lenders from risks associated with changes in government policies.

The National Integrated Power Project (NIPP)

The National Integrated Power Project (NIPP) was conceived in 2004 as a major fast-track initiative to add significant new generation capacity to Nigeria's electricity supply industry using gas-based power plants. The generation projects were accompanied by supporting transmission, distribution and gas transport infrastructure projects and at the time financed from the Excess Crude Oil Fund.

The Niger Delta Power Holding Company Limited (NDPHC) serves as administering institution for the contracts, management and operation of the assets developed and built under the NIPP using private sector best practices. After suffering some challenges in year 2008 and 2009 due to financial allocations, a new structure was formulated under NDPHC to manage the construction projects and finally disinvest the projects to private investors.

Similar to the other public assets in the power sector, the ten key NIPP power plants were chosen to be privatised. This involved the following facilities: Gbarain (254 MW), Benin (508 MW), Omotosho (513 MW), Egbema (381 MW), Omoku (265 MW), Geregu (506 MW), Calabar (634 MW), Ogorode (508 MW), Alaoji (1,131 MW), and Olorunsogo (754 MW), with a combined generation capacity of 5,453 MW. Today, the NIPP power plants have an available generation capacity of 2,500 MW which however is severely restricted by the shortage of gas. Full capacity can be reached if challenges in the gas supply for remote plants are solved and if a steam cycle is installed in the plants where possible. Up to date government invested $8.26 billion in the NIPP programme and is currently negotiating contracts with the companies that emerged as preferred bidders in the competitive disinvestment process.

Prior to their sale, each power plant was structured as individual GENCO. NDPHC required further that the systems would have to be fully commissioned beforehand with all contractual structures in place. This set-up should reduce the exposure of investors to technical risks from the construction and commissioning phase. The plants have been or are being constructed by international engineering, procurement and construction (EPC) contractors using proven technology and established original equipment manufacturers (OEMs). On the commercial side, the configuration follows the IPP modality recently developed in the market. The generation companies will sell the electricity under a 20-year power purchase agreement to NBET. The corresponding tariff will reflect the rates set forth in the most recent multi-year tariff order. Each GENCO will procure its feedstock (natural gas supplies) under long-term gas supply agreements with the Gas Aggregation Company of Nigeria (GACN). GACN was formed on January 5, 2010 and is owned by the upstream joint ventures formed between NNPC and international oil companies operating in Nigeria.

According to NDPHC the second phase of the National Integrated Power Projects (NIPPs), which will concentrate on building hydro power generation plants, will add 4000 MW of electricity to Nigeria's generation profile. This will include the construction of the 1,030 MW Mambilla hydro power project and 16 other identified medium and small hydro power projects. Furthermore, the second phase of the NIPPs will also include the construction of critical transmission projects that will enable the country wheel over 20,000 MW of electricity generated from existing and new power stations to distribution networks across the country.

[17] The development objective of the Power Sector Guarantees Project for Nigeria is to increase the supply of electricity received by Nigerian consumers. The project supports one component, partial risk guarantee (PRG) series with three sub-components based on the type of transactions supported: (i) greenfield independent power producers (IPP) transactions will include the option of both credit enhancement for Nigerian bulk electricity trading (NBET) and private debt mobilisation support, that is: (a) the NBET credit enhancement guarantee, with or without letter of credit; (b) the commercial debt mobilisation guarantee; or (c) a combination of both forms of guarantees; (ii) privatisation of generation companies (GENCOs) will include both gas-fired as well as hydropower companies; (iii) under privatisation of distribution companies (DISCOs), the ability of the DISCOs to successfully turn around dismal customer service levels and improve revenues flows to finance investments upstream in the value chain will make or break the power sector reform efforts. Out of the 11 DISCOs being privatised, four have been identified as advanced stage candidates: Abuja DISCO, Benin DISCO, Eko DISCO, and Ikeja DISCO. (cf. World Bank Project ID: P120207)

[18] IBRD, IDA and MIGA form part of the World Bank Group.

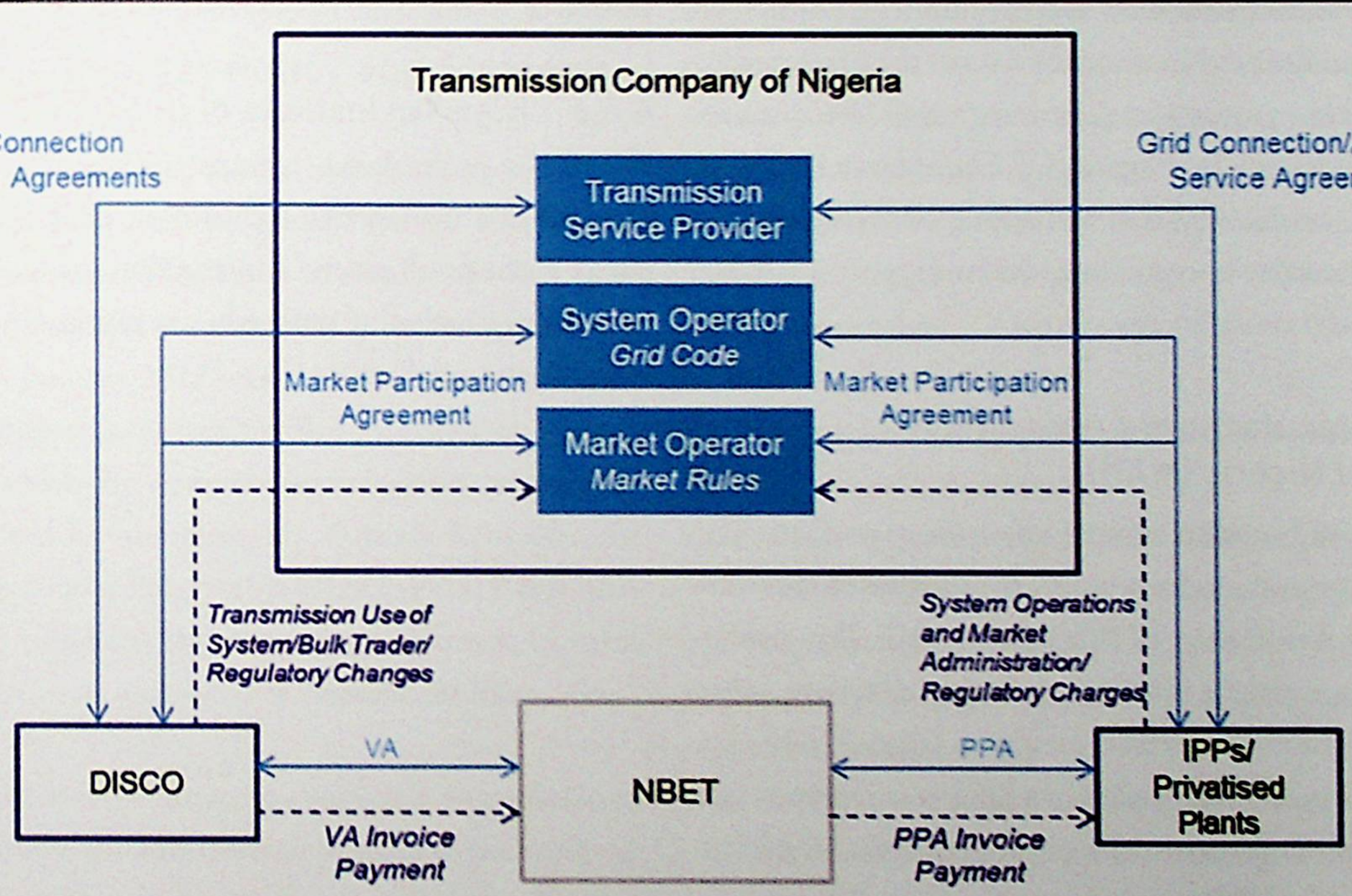
4.3.2 Transmission Company of Nigeria

The neutral role of grid owner is played by the TCN, which holds PHCN's grid assets and manages it on behalf of the government. Management has been outsourced to a private Canadian company. The operation of TCN includes the key three functions of market operator (MO), system operator (SO) and transmission service provider (TSP). Governmental plans are to separate the TSP entity from the MO and SO allowing it to become a privatised commercial company. Figure 4 – 3 shows the responsibilities more in detail.

4.3.3 Distribution Companies

For the market to operate freely, the generating companies must be able to sell their electricity to distribution companies who then sell it to the end consumers. NERC sets the tariffs that these off-takers must pay the GENCOs just as it sets the remuneration the DISCOs shall receive from consumers in what has to date been a highly subsidised system in which many electricity bills were never paid. Nevertheless, planning has gone ahead and the 11 licenses for the DISCOs awarded. In many cases, the respective states have shares in the companies (cf. Chapter 3.9).

FIGURE 4 – 3:
THE TRANSMISSION COMPANY OF NIGERIA



DISCO: Distribution Company
VA: Vesting Agreement
NBET: Nigerian Bulk Electricity Trader
IPP: Independent Power Producer
PPA: Power Purchase Agreement

(Source: GOPA-International Energy Consultants GmbH)

4.4 Other Non-Governmental Stakeholders

Other stakeholders are active in the fields of renewable energy, energy efficiency and rural electrification. Some organisations are mentioned below in a non-exhaustive list.

4.4.1 Council for Renewable Energy in Nigeria (CREN)

The Council for Renewable Energy in Nigeria (CREN) is a non-profit multi-stakeholder association which promotes the use of renewable energy technology in Nigeria and the reduction of greenhouse gas emissions. CREN acts as a forum where stakeholders such as industry, politics, academics and financial institutions discuss the development of renewable energies and their integration in a sustainable energy strategy for Nigeria. CREN addresses issues of awareness, availability, cost and appropriate implementation of renewable energies in order to support a reliable, economically viable energy system.

4.4.2 Manufacturers Association of Nigeria (MAN)

Nearly 2000 Nigerian companies of the manufacturing, construction and service sectors are members of the Manufacturers Association of Nigeria (MAN). The association represents their interests vis-à-vis politicians, other sectors of the economy and society at large. MAN also formulates policy suggestions seeking to ensure an efficient and profitable environment for manufacturers. (c.f. Chapter 7.4.2.) [22]

4.4.3 Nigerian Society for Engineers (NSE)

The Nigerian Society for Engineers (NSE) is an organisation for the engineering profession in Nigeria. The society represents engineers and their matters in politics, society and industry. For example it seeks to promote and maintain a high standard of formal engineering education and to enhance engineering research. In this context the NSE arranges study tours, organises conferences and publishes books and journals.

4.4.4 Green Building Council of Nigeria (GBCN)

The Green Building Council of Nigeria (GBCN) is involved in the development of a green building rating system. This rating system shall unify competing concerns in order to provide a single metric to assess the relative sustainability of a building. [71]

4.4.5 Nigerian Institute of Architects (NIA)

NIA is a member organisation of professional architects with the objective of promoting the practice of the profession of architecture in Nigeria. [60]

4.4.6 Nigerian Institute of Building (NIOB)

NIOB is a professional institute in Nigeria for persons engaged in a managerial, technical or administrative capacity in the development, construction and maintenance of buildings, including those who are engaged in academic research and teaching. [41]

The energy policy of Nigeria mainly encompasses the development and regulation of the petroleum and electricity industry. Both sectors were characterised by large government agencies that were responsible for a large part of the activities but have undergone significant changes in recent years. These sector and market modifications are mainly driven by a constant move towards privatisation and liberalisation.

First a general overview of the two relevant energy markets (petroleum and electricity) is provided followed by a short excursus on Nigeria's climate policy. In a second step, key policy and regulatory documents are reviewed more in detail in a chronological order.

5.1 Fuel Market Policy and Strategy

One of the pillars of the Jonathan administration's Transformation Agenda is the progressive deregulation of the petroleum industry. The partial removal of the fuel subsidy on Premium Motor Spirit (PMS) by the federal government in January 2012 was intended to conserve and maximise Nigeria's oil wealth. The government set up a fund into which the revenue otherwise dedicated to the subsidy would be funnelled, the Subsidy Reinvestment and Empowerment Programme (SURE-P) [57]. It is mandated with using the subsidy savings to invest in infrastructural projects and social empowerment initiatives.

At the same time, by initiating a complete elimination of the fuel subsidy, the administration seeks to promote the establishment of new private-sector refining capacities in-country. Applications have been filed for licences for this purpose, above all to build a large refinery in the Lekki Free Trade Zone, Lagos. The foundation of new refineries would serve to ease the regular market bottlenecks experienced in petroleum products. This goes hand in hand with some of the objectives set out in the "Draft Petroleum Industry Bill". [PIB; 2012] The PIB stipulates the management and allocation of petroleum resources shall be in accordance with the principles of good governance, transparency, and promote sustainable development and economic value added. [PIB; 2012] The approval of the Bill by Parliament has been pending since several years. In the course of this period, there has been a tendency among International Oil Companies (IOC) to sell off onshore oil blocks to indigenous companies and to focus operations offshore.

The PIB defines all aspects governing the exploitation, administration and organisation of the petroleum sector in Nigeria. It will supersede all previous petroleum-related laws such as the Petroleum Profits Tax Act or the Deep Offshore and Inland Basin Production Sharing Act. After establishing the objectives, the Act tackles all major areas of the sector which are: the management of the petroleum industry by institutions and definitions for upstream petroleum, downstream licensing, downstream petroleum, indigenous companies, health as well as safety and environment, taxation in the petroleum industry and stipulations for the organisation of the transition towards this new law.

The major items and stipulations can be summarised as follows:

- The bidding processes for the award of mining licences is monitored by the Nigeria Extractive Industries Transparency Initiative (NEITI)
- The re-structuring of the petroleum industry administration, with the
  - Minister of Petroleum Resources being responsible for the formulation and monitoring of the petroleum policy; the negotiating and implementing of international petroleum treaties and agreements with other countries or agencies on behalf of the government; and advising the President on appointments of chief executives of all companies and agencies established pursuant to the Act.
  - Petroleum Technical Bureau ('the Bureau') tasked to provide technical professional support to the Minster on matters relating to the petroleum ministry.
- The requirement for the administration to conduct a

public inquiry in the case of planning changes to the regulation.

- Reorganisation of the petroleum equalisation fund and its administration
- The transfer of the NNPC into separated, unbundled companies catering for the sub-sectors and their successive privatisation:
  - The National Petroleum Assets Management Corporation
  - The National Oil Company
  - The National Gas Company

5.2 Electricity Market Policy and Strategy

5.2.1 Introduction

The policies governing the electricity market and corresponding regulations have undergone significant changes in the last two decades. The main focus has been the drive from a monolithic, vertically-integrated organisation under the roof of the state-owned utility National Electric Power Authority (NEPA) toward a multi-actor landscape in a liberalised and privatised market. In the late 1990's the population and the economy both grew rapidly while NEPA failed to keep pace with this demand increase by adding more generation capacity and expanding the electricity system. This development led into an energy supply crisis in 2001. In reaction to the situation, in 2001 the Federal Executive Council (FEC) issued the National Electric Power Policy (NEPP), aimed at fundamental changes of ownership, control and regulation of the power sector. This and subsequent policies as well as legislative changes focused on privatisation and liberalisation of the electricity sector.

This fundamental change was kicked off under the assumption that the creation of an investor-friendly environment with low participation of governmental institutions and strong central regulation would help the country to overcome the previously poor service, low availability and high frequencies of outages in the system. The policy was the basis for the formulation of the Electric Power Sector Reform Act (2005), which constitutes the legal foundation for the process. The transfer of NEPA to PHCN and the subsequent splitting up of its assets into 18 separate successor companies responsible for generation, transmission and distribution as well as the establishment of the regulatory authority NERC are the central pillars of the reform. For a detailed description of the privatisation process see also Chapter 3.

On the commercial side, the Transitional Electricity Market (TEM) was declared by NERC and commenced with the beginning of February 2015. Power trading arrangements are from now on bound by contracts. This is the result of the first major step in the reform process set in motion in 2010, when President Goodluck Jonathan inaugurated the Roadmap for Power Sector Reform based on the 2005 EPSRA, aiming at the successful delivery of the reform milestones embedded in the roadmap. The roadmap contained two core objectives at its launch:

Firstly, to transition the Nigerian power sector into a private-sector led market ("The Reform Objective") by instituting transparent and responsible management, limiting political interference, eliminating government involvement in utility management, and encouraging private investment in generation (privatisation of PHCN and NDPHC assets). At the same time, the idea was to create a level playing field for all investors. Secondly, the reform process was intended to support and improve service delivery levels during this transition to the Nigerian public ("The Service Delivery Objective").

The overall intention behind the reform process was twofold: to release government funds otherwise tied down in generating capacity and to avoid having to commit substantial public-sector revenues to providing additional capacity. In this way, government would be able to focus more strongly on education, health and other infrastructure projects. At the same time, the hope was also that the reform would encourage fast expansion of the power

sector by ensuring it was market-driven and that the shortfall in generating capacity and the attendant potential demand would provide attractive opportunities for private investments.

Coincidentally, the Presidential Action Committee on Power (PACP) was set up to fast-track the reform process by enabling regular, fast round-table and cross-ministerial decision-making.

Finally, the process of the continuous changes over the last two decades has been instrumental to the achievement of the following key reform milestones include:

- New Tariff (MYTO II) instituted – June 2012
- Appointment of Manitoba Hydro International as TCN management contractor – June 2012
- Winning Bidders for GENCOs and DISCOS announced – November 2012
- Payment of 25% of the equity sale value by purchasers – February 2013
- TCN Board Inauguration - April 2013
- Eurobond Commitment for Capitalization Support of NBET and Project Financing of TCN – May 2013
- MYTO II Minor Tariff Review – June 2013
- Outstanding 75% payment of power assets by bidders – August 2013
- Handover of PHCN DISCOs and GENCOs to new owners – November 2013
- 15% cash payments by the preferred bidders for the assets in early 2014.
- Bidding process for NIPP GENCOs completed in spring 2014.
- MYTO 2.1: minor tariff review and review of ATC&C losses – January 2015
- Commencement of the Transitional Electricity Market ("TEM") – February 2015
- Amended MYTO 2.1: adjustment of ATC&C losses – April 2015

5.2.2 Major Programmes and Initiatives, Policy Mix

All policy stems from the Electric Power Sector Reform Act of 2005. In line with its goals, a National Energy Master Plan (NEMP) was formulated with a short-term horizon of 18 months, which culminated in an Electricity Master Plan in 2008. A roadmap for the reform of the sector was drawn up and approved in 2010, on the basis of which MYTO II was issued in 2012, while the grid and distribution codes were likewise set. In 2015 MYTO 2.1 was put into effect, delivering a revalidation of ATC&C losses as well as a minor tariff review. The TEM commenced with effect from 1st of February 2015. The TEM is characterised by "contract based arrangements for electricity trading and the introduction of competition for entry into the Market" [74]. This means that all electrical trading arrangements are bound by contracts. Hence Power Purchase Agreements (PPA), Vesting Contracts and Gas Supply Agreements, executed during the privatisation process, are effective now [75] (see Chapter 3 for further details).

This overall process occurred simultaneously to the preparation of the Gas Master Plan. During this period, the Renewable Electricity Action Programme, launched in 2006, was shored up first, in 2010, by the National Policy and Guidelines on Renewable Energy, and then in 2012 by the Renewable Energy Master Plan. The plan still has to be enacted but is consistent with the MYTO 2.1 tariff provisions for renewables. A National Renewable Energy and Energy Efficiency Policy (NREEEP) was developed in 2013 – 14 by the FMP and approved by the Federal Executive Council in May 2015. The draft Energy Efficiency Bill still awaits enactment. The same situation prevails as regards rural electrification, where despite having released an initial Rural Electrification Strategy and Implementation Plan in 2006 and this having progressed in various forms to culminate in the Rural Electrification Strategy and Plan, no legislation other than the general Power Sector Reform Act has been forthcoming. This means inves-

tors face a conundrum: The policy intention of buttressing renewables and rural electrification is clear, but as yet there is no firm regulatory regime governing them. It remains to be seen whether the rather high-level NREEEP is able to fill this void.

Other than the Renewable Electricity Action Programme and the industry incentives for Renewable Energy (e.g. MYTO 2.1), to date no mainline national programmes are in place that complement the policy mix. These two programmes are intended to support policymaking, but without clearly enacted laws or approved master plans it is hard to see what impact they can have. The main bodies of legislation (policy mix) and the various programmes put in place to support the use of renewable energy sources, rural electrification and energy efficiency measures are the subject of the Chapters 6, 7 and 8, respectively.

5.3 Climate Change Policy and Strategy

On September 12, 2012, the Federal Executive Council (FEC) approved a National Adaptation Strategy and Plan of Action on Climate Change for Nigeria (NASPA-CCN) as a national document for implementing climate change activities in Nigeria [3]. The policy is in line with the United Nations Framework Convention on Climate Change and the Kyoto Protocol.

A National Advocacy Campaign on Adaptation in Nigeria (NACAN) was set up to review the national policy on climate change strategy and the NASPA-CCN in detail every five years. The first review of the NASPA-CCN in 2015 will allow Nigeria to incorporate experiences into the 2015 review of Nigeria's efforts to achieve the MDGs. Looking further to the future, the ten-year time frame for the second NASPA-CCN review cycle is in line with the timeframe of Nigeria Vision 20:2020.

The strategy entails the vision of creating a country in which climate change adaptation is an integrated component of sustainable development, reducing the vulnerability and enhancing the resilience and adaptive capacity of all economic sectors and of all people – particularly women, children, and men who have little resources – to the adverse impacts of climate change, while also capturing the opportunities that arise as a result of climate change.

Its goal is to take action for adapting to climate change by reducing vulnerability to climate change impacts and increasing the resilience and sustainable wellbeing of all Nigerians; and to reduce or minimise risks by improving adaptive capacity, leveraging new opportunities, and facilitating collaboration inside Nigeria and with the global community. The principal aspects under this context are desertification, loss of forest cover, carbon dioxide emissions, water scarcity or other changes in the environment that directly affect the livelihood of people.

The climate change policy regards energy resources and connected infrastructure as vulnerable to the impacts of climate change. Since the supply of energy is a service of public interest, any negative change of its availability and quality impedes the development of other sectors and citizens. So-called sustainable energy and also renewable energy is regarded as a one of the measures to reduce risks as regards energy supplies and the pressure on the environment. The mitigation effect such technologies could have due to their reduced or even non-existent emissions on the climate changes themselves are not considered as a reason for their promotion.

The FMENV's dedicated climate change unit has a key role to play in the implementation process and has since the inception of the policy and strategy been devising the relevant programmes [52]. The programmes of the ministry are further detailed in Chapter 6.1.2.

5.4 Milestones in National Energy Policy and Laws

This Chapter contains a summary of each of the major strategies, policies, acts, regulations, norms and standards with a focus on the power sector. The relevant legislative and regulatory documents are summarised in chronological order. An overview on the policies and regulations is also depicted in Figure 5 – 1.

FIGURE 5 – 1:
OVERVIEW OF PRINCIPAL POLICIES AND LAWS

SUPREME LAW

Constitution

Policy and Strategy

Overarching
1. Nat. Elec. Power Policy
2. Nat. Energy Policy (2003)
3. Nat. Economic Empowerment Development Strategy (2004)
4. Nat. Energy Master Plan (2007)
5. Electricity Master Plan (2008)
6. Vision 20-2020 (2010)
7. Roadmap for Power Sector Reform (2010)
8. National Renewable Energy and Energy Efficiency Policy (2015)

Renewable Energy
1. Renewable Electricity Policy Guidelines (2006)
2. Renewable Energy Master Plan (2012)

Energy Efficiency
1. National Energy Efficiency Policy (2012,draft)

Rural Electrification
1. Rural electrification Strategy and Implementation Plan (2006)
2. Rural Electrification Policy Paper (2009)
3. National Rural Electrification Strategy and Plan (2015, draft)

Others
1. Nigerian Biofuel Policy Incentive (2007)

Legislation, Regulation and Standards

1. Electricity Power Sector Reform Act (2005)	1. MYTO I, II, II.1 (2008, 2012, 2015) 2. REFiT guidelines (2012) 3. Regulations: Embedded Generation (2012), IEDN (2012), Bulk Procurement (2014)	1. Self-ballasted lamps for general lighting services (2012) 2. Self-ballasted lamps for general lighting services safety requirem. (2012)

Programmes and Incentives

1. Renewable Energy Action Prorgamme (2006)	2. RE Competitive Procurement System (under preparation)

Note: Programmes and Incentives are initiated by respective Federal Ministries and Agencies to implement draft or finalized RE, EE, and RrE policies. Incentives are to guide and encourage private sector investment and involvement in the sector.

RE, EE and RrE Achievements

1. Creation of NERC and REA 2. Unbundling of the Nigerian Power industry 3. Nat. RE and EE Policy approved
4. The ongoing power sector reform paved way for the need to streamline and develop policies and standards comparable with international best practice.

Gaps, Alignment and Overlaps

General Policy Gaps 1
1. Many draft/existing policies lack implementation and follow-up systems
2. The ERSP Act 2005 is now due for review
3. Need for the introduction of EE legislation
4. Need to introduce more voluntary RE and EE standards
5. Need to streamline institutional activities and mandates in relation to RE, EE and RrE policy formulation
6. Lack of coherent and consistent RE and RrE policies
7. No perfect knowledge of activities carried out among various Ministries and agencies

General Policy Gaps 2
1. Building standards need updates and in places new ones to be developed
2. Very limited RE and RrE voluntary standards
3. Increased involvement of State and Local Governments in the RE, EE and RrE sector is required
4. Limited follow-up plans for all policies and targets
5. Limited alignment of activities of REA and State Rural Electrification board

Alignments Required	Existing Opportunities	Overlaps	Alignment required	Existing opportunities	Overlaps
Closer coordination between ECN and other Ministries e.g. FMP, FME, NERC etc is essential	1. Current reform to integrate RE, EE and RrE 2. RE, EE and RrE ambitious targets included in national policy 3. ICREEE re-activated	ECN, FMP and FME driving RE, EE and RrE policies and programmes in conflicting manner	Increase harmonization of national RE, EE and RrE policy objectives	1. State and local rural electricity board's access rural electrification support through REA 2. Scope for SON, NESREA and FMHUD to develop voluntary standards comparable with international best practice	Some Agencies' activities duplicate that of the Federal Ministries

Source: [GIZ; Oct 2013]

5.4.1 National Electric Power Policy (NEPP), 2001

This policy statement was the initial step towards reforming the electricity sector. It is the result of the consultations of the Electrical Power Implementation Committee (EPIC), the central body tasked to elaborate, coordinate and monitor all activities relating to the reform, restructuring and privatisation of the power sector [Dayo; 2008]. It defined the three principal phases for achieving the reform goal of a reliable and sufficient energy system. The first step aimed at the privatisation of the vertically-integrated parastatal company NEPA and the introduction of IPPs as well as private emergency power producers. The second step focused on increasing the competition between market participants, reduction of subsidies (i.e. payment of full fuel prices) and sale of excess power to DISCOs. During the last phase the market and competition would even be more intensified by full cost pricing of supply, liberalised selection of supplier beyond the local DISCOs by larger customers and full competitive market trading.

The provisions were – to a large extent – incorporated into the Electric Power Sector Reform (EPSR) Act of 2005 [FMPS; 2006]. This marked the milestone for the implementation of the reform policy.

5.4.2 National Energy Policy (NEP), 2003

This document was designed to stand as the first overall framework for the development of the sector and its effective contribution to the country's economy. It covers the development, exploitation and supply of all energy resources (petroleum and electricity), their utilisation by different sectors and other related topics such as the environment, energy efficiency and energy financing as well as energy policy implementation. [ECN; Apr 2003]

After a short introduction and overview, it looks briefly at the various aspects, describes the policy goals and lists individual objectives for the policy – which could also be understood as indicators to measure the achievement of the policy goals. The policy includes renewable energy sources, rural electrification and expansion of electrification as well as energy efficiency at many points of the sector-wide framework. In this context, it elaborates in a very straight-forward manner on the policy goals, strategies and goals for the respective energy sources including renewable energy and rural electrification. It therefore provides the basis for subsequent changes in the sector such as the establishment of the Rural Electrification Fund later incorporated under the Rural Electrification Agency as well as constituting a blueprint for all subsequent policies on the promotion of renewable energy.

Although parts of the policy required an update and new developments in the sector were covered in subsequent policy papers or acts, the policy still remains in force as the guiding principle for the direction of sector reforms. In 2013, NEP was reviewed to reflect recent developments Energy sector with emphasis on Renewable Energy and Energy Efficiency, amongst others [48]

Renewable energy: The NEP 2003 recognises that the level of energy utilisation in an economy coupled with efficiency of the conversion of energy resources is vital for the development of the economy. Thus, it made provision for all forms of energy including renewable energy sources and how they can be effectively utilised. However, no concrete quantitative targets have been set.

Energy efficiency and conservation: NEP 2003 pointed out that energy utilisation of the country is far from efficient and called for the promotion of energy conservation at all levels of exploitation of the nation's energy resources by adopting energy efficient methods in energy utilisation. However, no concrete quantitative targets have been set.

Rural electrification: NEP 2003 recommends the promotion of off-grid and standalone systems in order to supply electricity to remote areas of the country.

5.4.3 National Economic Empowerment and Development Strategy (NEEDS), 2004

The strategy issued in 2004 by the National Planning Commission under President Obasanjo was intended as the response to the development challenges of Nigeria. It was intended to guide combating the grossly underestimated extent of social, political, and economic decay in the country since 1999, to serve as an overarching statement for the following years (2003-2007) to consolidate the achievements of the previous legislative period and formulate the basis for further sustainable poverty reduction, employment generation, wealth creation, and value reorientation.

As regards infrastructure, the policy promotes the privatisation of infrastructure which is regarded as key instrument for achieving improved service delivery. The government would still remain important for funding projects with high investment requirements or low attractiveness for the private investors (i.e. rural areas). The document further suggests increasing the share of renewable energy in the total energy mix. It again stresses the need for the renewable energy agency and its equipment with respective funds through the Electric Power Sector Act (i.e. the National Power Sector Reform Act). It therefore represents one more step towards inclusion of the role of renewable energy in the power sector and emphasises the importance of continued efforts for rural electrification.

5.4.4 National Power Sector Reform Act (EPSRA), 2005

In 2005, the Nigerian power sector was liberalised by the Electric Power Sector Reform Act (EPSRA) [EPSRA; 2005]. This Act, which is a consequence of the National Electric Power Policy adopted in 2001, provides a new legal and regulatory framework for the sector. The fundamental change it entailed was the privatisation of the government-owned electricity company and the process towards a completely liberalised market. It makes provisions for the vertical and horizontal unbundling of the electricity company into separate and competitive entities; development of a competitive electricity markets; setting out of a legal and regulatory framework for the sector; a framework for rural electrification; a framework for the enforcement of consumer rights and obligations: establishment of performance standards. It resulted in the transfer of the previously public power company, NEPA, into a (temporary) Holding Company, the Power Holding Company of Nigeria (PHCN) - called "Successor Company" in the legal text. The reform act in general kicked off the horizontal and vertical unbundling and privatisation of the NEPA by the following processes:

1. Transfer of NEPA assets to the holding company PHCN and its successive restructuring by privatisation and transfer into 18 different generation, distribution and transmission companies;
2. Development of a competitive electricity market by creation and operation of a wholesale electricity market in Nigeria;
3. Foundation of the Nigerian Electricity Regulatory Commission (NERC) as national regulatory body to oversee the market and administer licences;
4. Requirements for licensing, its conditions and regulation of the generation, transmission, system operation and distribution, as well as supply of generated electricity;
5. Introduction of tariffs and corresponding calculation methodologies to be elaborated and adopted by NERC;
6. Implementation of consumer rights and consumer protection including the Power Consumer Assistance Fund to subsidise the tariff for less-privileged consumers;
7. Use guiding standards and codes as guidelines and requirements for activities in the sector;
8. Establishing a Rural Electrification Agency to expand access to electricity to the rural areas and the financing of its activities.

The reforms under this Act were to be done in consecutive phases. The implementation of the reform started