FEDERAL REPUBLIC OF NIGERIA

SUSTAINABLE ENERGY FOR ALL ACTION AGENDA (SE4ALL-AA)

ADOPTED BY

INTER-MINISTERIAL COMMITTEE ON RENEWABLE ENERGY AND ENERGY EFFICIENCY (ICREEE)

APPROVED BY

NATIONAL COUNCIL ON POWER (NACOP)

First Edition: July, 2016

ACKNOWLEDGMENTS

The Sustainable Energy for All (SE4ALL) Action Agenda for Nigeria has been developed through concerted efforts of over twenty Ministries, Departments and Agencies of the Federal Government of Nigeria, with inputs from representatives of 36 states and the FCT as well as the Private Sector, NGOs, Civil Society, Academia and Development Partners in Nigeria. The work was prepared with the support ofECOWAS Centre Renewable Energy and Energy Efficiency (ECREEE) additional support was received from SE4All Africa Hub-AfdB, GIZ-NESP, UNDP and several other Development Partners.

Contacts:

Engr. A. Adebisi
Director, Renewable Energy and Rural Power Access Department (RRD)
Ministry of Power, Works & Housing, Abuja, Nigeria
Email: yomibisi@yahoo.com
Telephone: +2348075443121

Engr. Faruk Yusuf Yabo:
Assist. Director, Renewable Energy and Rural Power Access/
SE4All Focal Point Person
Federal Ministry of Power, Works & Housing, Abuja, Nigeria
Email: fyyabo@yahoo.com
Telephone: +234 803 8521476

Contents

List of Tables

List of Figures

ACRONYMS

ACRONY	DESCRIPTION
%	Percentage
AA	Action Agenda
AfDB	African Development Bank
BOO	Build, Own, and Operate
CBN	Central Bank of Nigeria
CDM	Clean Development Mechanism
DISCOs	Distribution Companies
EA	Energy Access
ECN	Energy Commission of Nigeria
ECOWAS	Economic Community of West Africa
ECREEE	ECOWAS Centre for Renewable Energy and Energy Efficiency
EE	Energy Efficiency
EPSR	Electricity Power Sector Reform Act
EU	European Union
FCT	Federal Capital Territory
FEC	Federal Executive Council
FIT	Feed-in Tariff
FMARD	Federal Ministry of Agriculture and Rural Development
FME	Federal Ministry of Environment
FMEdu	Federal Ministry of Education
FMJ	Federal Ministry of Justice
FMLHUD	Federal Ministry of Land, Housing and Urban Development
FMP	Federal Ministry of Power
FMPR	Federal Ministry of Petroleum Resources
FMST	Federal Ministry of Science and Technology
FMWA	Federal Ministry of Women Affairs
FMWR	Federal Ministry of Water Resources
GACC	Global Alliance for Clean Cookstoves
GDP	Gross Domestic Product
GEF	Global Environmental Fund
GENCOs	Generation Companies
GFT	Global Facilitation Team
GIZ	**Deutsche GesellschaftfürInternationale Zusammenarbeit GmbH** (German Agency for International Cooperation)
IAEA	International Atomic Energy Agency
ICEED	International Centre
ICRC	Infrastructure Concession and Regulatory Commission
ICREEE	Inter-Ministerial Committee on Renewable Energy and Energy
ICT	Information Communication Technology
IPP	Independent Power Producer
KV	Kilo Volt
KWh	Kilo Watt hour
LHP	Large Hydro Power
LPG	Liquefied Petroleum Gas
MAN	Manufacturers Association of Nigeria
MDA	Ministries, Department, and Agency
MDG	Millennium Development Goals
MEPS	Minimum Environmental Performance Standard
MTOE	Million Tonnes Oil Equivalent
MW	Mega Watt
MYTO	Multi Year Tariff Order
NABDA	National Biotechnology Development Agency
NACCIMA	Nigerian Association of Chambers of Commerce, Industry, Mines, and
NAEC	Nigeria Atomic Energy Commission
NAPTIN	National Power Training Institute of Nigeria

NASENI	National Agency for Science and Engineering Infrastructure
NASS	National Assembly
NBS	National Bureau of Statistics
NBTE	National Board of Technical Education
NCCS	National Clean Cooking Scheme
NCEEC	National Centre for Energy Efficiency and Conservation
NELMCO	Nigerian Electricity Liability Management Limited
NEMSF	Nigerian Electricity Market Stabilisation Facility
NEPA	Nigerian Electric Power Authority
NEPAD	New Partnership for Africa's Development
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
NHLSS	Nigerian Harmonised Living Standard Survey
NIMET	Nigerian Meteorological Agency
NIPP	National Integrated Power Project
NITT	Nigeria Institute of Transport Technology
NLNG	Nigeria Liquefied Natural Gas
NNPC	Nigerian National Petroleum Corporation
NNRA	Nigeria Nuclear Regulatory Agency
NOA	National Orientation Agency
NPC	National Planning Commission
NREEEP	Nigerian Renewable Energy Efficiency Policy
NUC	Nigerian Universities Commission
OLRN	Operation Light -Up Rural Nigeria
OPEC	Organisation of Petroleum Exporting Countries
PHCN	Power Holding Company of Nigeria
PPMC	Petroleum Product Marketing Company
PTFP	Presidential Taskforce on Power
PV	Photovoltaic
R&D	Research and Development
RE	Renewable Energy
REA	Rural Electrification Agency
REMP	Renewable Energy Master Plan
REMU	Renewable Energy Micro Utility
RESIP	Rural Electrification Strategy and Implementation Plan
RUWES	Rural Women Energy Security
SDG	Sustainable Development Goals
SE4ALL	Sustainable Energy for All
SHP	Small Hydro Power
SON	Standard Organisation of Nigeria
TEM	Transitional Electricity Market
TPES	Total Primary Energy Supply
TSP	Transmission Service Provider
UBE	Universal Basic Education
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organisation
WACCA	West Africa Clean Cookstoves Alliance
WB	World Bank
WHO	World Health Organisation

EXECUTIVE SUMMARY

The key objectives of the SE4ALL initiative globally are to ensure universal access to modern energy services; doubling the global rate of improvement in energy efficiency; and doubling the share of renewable energy in global energy mix by 2030 compared to 2010. These objectives are premised around the proposition that national governments must design and implement a set of integrated country actions to drive transformative change of the world's energy systems; create the right investment environment for the private sector's participation; and the interplay of civil society organizations in identifying, advocating, and monitoring public policy and business action; mobilising social innovation and grassroots action; leading behavioural change; and helping to spread best practices and building capacity at all levels in partnership with governments and businesses.

Working within this framework, the ECOWAS Heads of States in October 2012 opted-in to the process mandating ECREEE to coordinate Member States efforts in this regard. Prior to this, the Nigerian Government had earlier demonstrated the commitment of his administration to the Initiative by launching the SE4ALL Nigeria in August 2012. This singular act placed Nigeria as one of the first Nations in the world to embrace the initiative. Thus, the objectives of the SE4ALL initiative are considered in tandem with the goals of the national energy agenda, which gives high priority to providing access to safe, reliable and affordable energy to our citizens in both urban and rural areas. Nigeria is well endowed with resources in both renewable and non-renewable energies which can constitute plausible solutions to address existing shortfalls in energy and power access of thecountry.

The SE4All initiative requires countries to set quantitative objectives for each of the three goals described in SE4ALL Global Agenda 2012, Nigeria's SE4All objective as presented is defined as follows:

	Targets Until 2030
Energy Access	• To increase electricity access from the current aggregate level of 40% (urban= 65%, and rural=28%) in 2015 to 75% (urban= 90%, and rural= 60%) by2020 • By 2030, the population share living without electricity supplies will drop from the current 60% in 2015 of the total population down to about10%. • To replace 50% of traditional firewood consumption for cooking by improved cookstove technology by 2020 and 80% by2030; • Working together with the private sector to roll-out LPG at affordable cost for Nigerians by 2020 and subsequently up to 2030; • By 2025 and 2030, nuclear energy is expected to contribute about 2.5% and 4% to available electricity mix • The electricity generation will increase from the present grid supply of 5000 MW in 2015 to at least 32,000 MW by 2030
Energy Efficiency	• By the end of 2015, efficient lighting (at least 5 times more efficient than incandescent lamps) will be used by 20% of the households, 40% by 2020 and almost 100% by 2030 • For high-energy consuming sectors (transport, power and industrial sectors), efficient energy technologies will be progressively introduced as well as other demand side management measures such as peak load management when possible. Compared with the current 2015 level, energy efficiency will increase by at least 20% by 2020 and 50% by 2030. • By 2016, energy audits will be compulsory for all high-energy consuming sectors and public buildings

Renewable Energy	• Nigeria's electricity vision 30:30:30 is to achieve a technology-driven renewable energy sector that harnesses the nation's resources to complement its fossil fuel consumption and guarantees energy security. Specifically, Nigeria's target for renewable energyis: • Nigeria's electricity vision 30:30:30 is to achieve a technology-driven renewable energy sector that harnesses the nation's resources to complement its fossil fuel consumption and guarantees energy security. Specifically, Nigeria's target for renewable energy is: • By 2030, renewable energy is expected to contribute about 30% share in the available electricity mix; • To achieve a 27% and 20% contribution of hydroelectricity (both large and small hydro) to the nation's electricity generation mix by 2020 and 2030 respectively; • To achieve a 2.5% contribution of wind energy to the nation's electricity generation mix by 2030; • To achieve a 20% and 19% contribution of solar energy (PV and Solar thermal) to the nation's electricity generation mix by 2020 and 2030 respectively; • To achieve a 4% power generation

Based on the figures presented in the National Renewable Energy and Energy Efficiency Policy (NREEEP 2015) and draft Rural Electrification Strategy and Implementation Plan (RESIP 2015) about 40% of the Nigerian population has access to grid connected electricity, out of which 72% reside in urban areas and 28% in rural areas. Out of the estimated 16.4 million rural households in the country, only about 4.6 million are connected to the electricity grid, hence the draft RESIP 2015 estimated between NGN 317.8 billion and NGN 525.8 billion [a minimum of NGN 50billion per annum] up to the year 2040 to deliver 100% electricity service to all rural household.

It is also estimated that a service extension to additional 471,000 rural households each year will be required from 2015 to 2020; and an annual additional 513,000 rural household connections from 2020 to 2040. A GIZ 2014 Nigeria Energy Study also indicated that about 20% of the country has access to clean and efficient cooking services. Nigeria's main energy carrier is biomass (81.25%), followed by natural gas (8.2%),petroleum products (5.3%), crude oil (4.8%), hydropower (0.4%), and others (< 1%). Over 50 million metric tons of fuel wood is also consumed annually, especially in rural areas where alternative fuels for cooking are limited or absent.

Following results from the baseline analysis and various rounds of consultations carried out in the thematic Working Groups organised by the members of Inter-ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE) with the public, private, and civil societies/development partners across the country, the Nigeria's SE4ALL AA sets out the following actions:

Energy Access

- **National Energy Plan-** A national energy plan will not only showcase the government's effort and plans towards achieving SE4ALL and SDG 7 goals but will also highlight the energy services of the country and technologies required to explore/deploy these sources.
- **Grid Infrastructure-** To guarantee supply efficiency immediate action needs to be taken with respect to upgrade of grid capacity and increase in generation capacity across the country
- **Promotion of Efficient Electricity Generation Technologies in Urban and Rural Areas-**

  Aggressive Rural Electrification and Access Plan- A plan designed by the REA in collaboration with SREBs, and in partnership with private sector stakeholders and civil society to bring energy solutions to rural communities that cannot be reached by the grid expansion between the short-medium term period (at least by2025).

  Electricity for Rural Productive Uses program- This program should target rural communities across the country and provide them with solar based solutions for lighting, refrigeration and water pumping.
- **Integrated Resource Plan-** the goal of the integrated resource plan will be to offer an opportunity to provide a plan for meeting the forecasted annual peak and power demand of the country.
- **Building and investing in robust national energy data management toolkit-** Energy data sourcing and management would provide the necessary link to develop future scenarios and plans for the energy sector.

Broadening Human and Institutional Capacity- Taking advantage of various on-going capacity developments in the sector notably the capacity building being provided by the National Power Training Institute of Nigeria (NAPTIN) and other10educationalinstitutionsacross the country to train and develop a wide range of technical and non-technical courses on the energy sector with support from development partners.

- The development and adoption of national cooking policies, strategies and targets, including legal and regulatory mechanisms in line with the existing ECOWAS regional policies, the SE4ALL initiative andSDG7.
- Nigeria should be the lead country on LPG thus a clear regional and national demonstration of Government commitment to the recovery of the LPG sector and extended access need to be clearly set out.

Renewable Energy

- With the recent approval of the NREEEP by the Federal Executive Council in May 2015, it is important to put in place a strategic implementation framework for the policy and link the same with the on-going regional activities, using the vehicles of National Renewable Energy Action Plan (NREAP), SE4ALLAA and SDG7.
- Develop/build a renewable energy data bank and put in place a sustainable system of maintaining same through a coordinated working relationship of all relevant MDAs.

Other notable actions include the followings:

- **Renewable Power Generation:**
  - Completion of on-going projects in Kastina and Plateau States (10 MW and 100 MW wind farms); 9 MW (Oyan dam) and 3 MW (Bakolori Zamfara)
- Building capacity for local manufacturing and fabrication of solar PVs, small wind turbines, small hydro power plants, and component parts in Nigeria;
- **Grid Infrastructure and Supply:**
  - Using the approved policy instruments (FIT and Competitive Bidding Systems) to create aright enabling environment for a private sector led construction of on-grid, mini-grid, and off- grid renewable energy power plants across the country
- **Industrial and Agricultural Processes**
  - Promote and adapt appropriate waste to energy technologies
  - Construct a private sector led renewable energy based energy supply infrastructure for industrial and agricultural processes in various locations across the country.

- **Building and Appliances**
  - The building code of Nigeria should make a mandatory provision for all new builds to be designed in such a way that allows renewable energy systems installations on roof tops e.g. solar panels and water heaters, small scale wind turbines etc.

- **Transportation**
  - Promote R&D in biofuel for transport sector.
  - Enact and enforce Biofuel usage Act on the use of E5, E10, B10, and E20 in Nigeria

Energy Efficiency

- The federal government through relevant MDA plans to approve a regulatory framework including a coordinating group for the implementation and administration of energy efficiency programmes arising from the NREEEP 2015.
- Energy efficiency issues are just beginning to receive significant attention in the country, there is need for information, advocacy, and awareness raising measures across the country.
- There is need for research, development, and demonstration to shape the emerging market of the sub-sector.
- National programmes for the adoption of technological standards for improved cookstoves and cooking fuels and appliances in terms of efficiency, (safety and health impacts) in accordance with international bodies such as the Global Alliance for Clean Cook Stoves (GACC) need to be developed.
- Develop national programs to implement an ISO-compatible Energy Management Standard (EMS) for Industry (ISO 50001) and introduce requirements for energy audits, e.g. for large companies, in the legal and regulatory framework.

Minimum Energy Performance Standards (MEPS) - Set mandatory requirements for minimum energy performance (luminous efficacy, lifetime, power fluctuation tolerance, power factor, light quality, mercury content; lumen maintenance, durability and quality, brightness, run time (off-grid)). A monitoring, verification and enforcement policy is also needed to facilitate the implementation of the MEPS.

- Introducing and implementing voluntary international standards or if in place, aligning national standards with international ones.
- Strengthen current capacity building efforts of the Standard Organisation of Nigeria (SON) on standards and regulations across the country. More laboratories and test centres should be established across the country for effective implementation of standards
- Through the joint efforts of relevant MDAs and other relevant stakeholders, develop support schemes and financial mechanisms for the emerging sub-sector.

The management of Nigeria's SE4All Action Agenda will be built on existing structure of the already established Inter-Ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE). Therefore there is an immediate need for the Federal Government to put in place the SE4ALL Secretariat, within the Federal Ministry of Power, who is the focal point for the Nation's SE4ALL activities. Within the secretariat as well an SE4ALL Steering Committee should be established to provide support to the Secretariat. Members of the Steering Committee will include the ICREEE team, FMF, FMEdu, CBN, TSP/SO/OM, State and Local Governments, DisCos, and GenCos. International Partners EU, GIZ, ECREEE, UNDP, AfDB, Civil Society Representative, National Banks, Private Sector, SME Reps etc. will serve as Donors Executive Committee.

The Secretariat will report directly to the Honourable Minister of Power and inform the SE4ALL Steering Committee (ICREEE team) and the Donor Executive Committee. It will be headed by the National Focal Point Person and supported by a dedicated team drawn from the Renewable Energy and Rural Power Access Department of the Federal Ministry of Power i.e. personnel of the Secretariat will be employees of the Federal Ministry of Power. However a Technical Advisors will be secured to support the SE4ALL Secretariat on a regular basis. The National Focal Point will be responsible for the monitoring and working with project implementation partners identified in the AA.

The Secretariat will coordinate the activities of ICREEE, States and Local Governments, and liaise with other MDAs whose activities and mandate impact on the SE4ALL AA goals. The role of the Secretariat therefore include; Nigeria's SE4ALL AA implementation hub; monitoring the AA progress and reporting, as well as information dissemination and knowledge sharing. The Ministerial Steering Committee should meet at least every month while the Donor Executive Committee should meet at least quarterly with small to medium renewable energy providers, civil society organizations and SME leaders as these are critical channels for the implementation of renewable energy programs and their impact on communities that are a key target of SE4ALL

.

The AA is therefore conceived as a living document that will be adapted and updated as progress is monitored and reported, new actions become more relevant and others are completed or the gap that prompted such action was overcome. It is recommended that the SE4ALL Secretariat undertakes two annual performance reports submitted to the Honourable Minister/ Permanent Secretary Federal Ministry of Power: (i) Mid-year progress report aimed at informing the Steering Committee, Donor Executive Committee, and other stakeholders of the progress of each of the programs relative to the targets, explain the variances and describe the actions to be undertaken to meet the targets; using the mid-year report as a yardstick and with the submission of progress report from the Steering Committee to (ii) provide a substantial analysis of the implementation of each program over the past 12-months (progress made, challenges, corrective measures, lessons learnt, etc.). It will be submitted soon after year-end, discussed with the stakeholders, and commitments made for the upcoming year.

PREAMBLE

The SE4All Action Agenda for Nigeria has been developed through concerted efforts of over twenty Ministries, Departments and Agencies of the Federal Government of Nigeria, with inputs from representatives of 36 states and the FCT as well as the Private Sector, NGOs, Civil Society, Academia and Development Partners in Nigeria. The work was prepared with the support of ECOWAS Centre Renewable Energy and Energy Efficiency (ECREEE) sponsored consultants led by *Dr. Afolabi Otitoju, Ph. D*., additional support was received from SE4All Africa Hub-AfdB, GIZ-NESP, UNDP and several other Development Partners.

The SE4All Action Agenda for Nigeria has been developed in line with the guiding principles contained in the Guidelines for Developing National Sustainable Energy for All Action Agendas in Africa that were developed by African stakeholders, notably: (i) Building on existing plans/programmes/strategies; (ii) Political commitment and leadership; (iii) A balanced and integrated approach; (iv) An inter-ministerial and cross-sectoral approach; (v) Adherence to sustainable development principles; (vi) Participation and meaningful involvement of all stakeholders; (vii) Gender equality and inclusiveness; and (viii) Transparency and accountability.

The Federal Government of Nigeria has shown strong commitment in accelerating Nigeria's SE4All Action Plan, and integrating the same within the broader policy framework, notably Vision 20:2020, which provides the main framework for national development. SE4All AA builds on these foundations to look at additional strategic issues that will need to be addressed to meet the longer-term challenges in the energy sector.

The Federal Ministry of Power is the designate focal point institution (FPI) for the overall coordination of SE4All activities in Nigeria, while the SE4All focal point person (FPP) appointed by the ministry will be responsible for liaison, stakeholder consultation, review, monitoring and reporting of progress among all stakeholders in the Nigerian SE4All action agenda implementation and coordination process

INTRODUCTION

(a) Country Context:

(i) Geography

Nigeria lies within the tropical zone (between N4.00°-N14.00°and E3.00-E14.00°) and occupies an area of about 923,773 km^2, i.e. about 3% of Africa's landscape (Adewale 2011), with a relatively high annual growth rate of 7% compared to 1.6% for other lower-middle income countries, and well over the 2.5% average for Sub-Saharan Africa. The country comprises 36 states and the Federal Capital Territory (FCT) Abuja. The states constitute the second tier of government and are further sub-divided into 774 local governments.

Figure : Map of Nigeria

Nigeria shares boundaries with the Republic of Niger to the north, Chad to the northeast, Cameroon to the east and southeast, the Republic of Benin to the west and the Gulf of Guinea to the south. The fragmentation of Nigeria's geographical, ethnic and cultural identity lines is effectively balanced by the country's federal structure and the strong emphasis of the federal government on representing six geopolitical zones and different ethnic and cultural identities. Figure 1 shows the map of Nigeria showing the 36 States of the Federation and the Federal Capital Territory, Abuja.

[1] GIZ (2015) The Nigerian Energy Sector- an Overview with a Special Emphasis on Renewable Energy, Energy Efficiency, and Rural Electrification (2nd Edition) Nigerian Energy Support Programme GIZ -EU June 2015

(ii) Demography

Nigeria's Population is the seventh largest in the World with over 190 million people (NPC 2016) and still growing by at least 2 per cent per annum. By United Nations' statistics, Nigeria's population will reach nearly 230 million within the next 20 years. This report estimate that at 2 per cent annual growth rate, the population will reach 267 million by 2030. The largest country in Africa currently, accounts for nearly half the total population of West Africa and more than 15 per cent of the total population of the entire African Continent. Nigeria represents over 65 per cent of the effective West African market and remains the most competitive destination for the establishment of medium and large manufacturing industries. More than 40 per cent of Nigeria's population is less than 20 years old, with functional literacy level placed between 30 – 40 per cent and well over 65 per cent on the (18 – 45 years) population segment. This indicates strong, sufficient and modern labour market.

(iii) Political System

To further consolidate the transition from military to democratic rule that began in 1999, Nigeria has been running an uninterrupted presidential democracy with the fifth national democratic election held in March/April 2015. Internationally, Nigeria continues to be a leading player in the African Union, the New Partnership for Africa's Development (NEPAD), and in the Economic Community of West African States (ECOWAS).

(iv) Economic Indicators

Nigeria's overall annual economic growth has averaged 6.77% since 2006. From various data source of the Central Bank of Nigeria presented in the 2013 Millennium Development Goals, it was observed that the non-oil sector growth has been the main driver of the country's economic growth and averaged 8.76% between 2006 and 2012 (Table 1). Inflation has averaged around 10.64% per annum, accompanied by a stable naira–US dollar exchange rate. In 2012, the deficit to GDP ratio was 2.90% and debt to GDP ratio was 19.40%. Primary traditional agriculture remains the dominant economic activity, accounting for about 40.0% of GDP and more than 60.0% of total employment. Other key contributors to GDP are the wholesale and retail trade (19.90%) and crude petroleum and natural gas (13.80%). These three sectors account for about 74.0% of total GDP. Manufacturing sector account for only 4.0%, making the economy tending towards a service driven one. Nigeria has the following credit rating by international rating agencies in 2016: S&P B+; Moody's B1; Fitch BB-.

[2]MDG (2014)

(ii) Other socio-economic indices

A number of other indicators, especially human development indices, have shown not-too-impressive outcomes. With 49% urban and 51% rural population (World Bank 2013), Nigeria's unemployment rate was estimated at 23.90% in 2011, as compared to 21.10% in 2010. In particular, youth unemployment was estimated at 37.70%, placing Nigeria among the countries with the worst youth unemployment in sub-Saharan Africa. Of equal concern are the poverty and inequality levels which have remained considerably high. The most recent nationally representative survey, the Harmonised Nigerian Living Standard Survey (NHLSS) 2010, indicated that the official poverty rate is at 46% of the population based on the adult equivalent approach, or at 62.60% in strictly per capita terms, which translates to over 100 million people living in absolute poverty. This situation obviously contrasts with the country's performance as shown by other macroeconomic indicators reviewed earlier, and points to an important policy challenge, which is that of translating economic growth into measurable improvement in people's welfare.

Table 1 : Key Macroeconomic Indicators

Indicator	2006	2007	2008	2009	2010	2011	2012	2013
GDP at current market prices (NGN billion)	18,709.8	20.940.9	24,665.3	25,225.1	29,108.0	33,994.6	40,544.1	44,103.9
GDP at current market prices (USD billion)	144.5	176.8	191.8	170.3	194.1	242.4	262.6	
GDP per capita (NGN)	132,604.3	144,474.5	170,515.0	165,633.9	185,759.5	179,158.3	240,190.2	
GDP per capita (USD)	1,030.3	1,223.5	1286.3	1,106.8	1,235.9	1,474.96	1,555.7	
Real GDP growth (%)	6.0	6.50	6.0	7.0	7.90	7.40	6.60	6.90
Oil sector growth (%)	-4.2	-4.5	-6.2	.50	.50	.50	-0.90	-0.24
Non-oil sector growth (%)	9.40	9.50	9.0	8.30	8.40	8.80	7.90	8.10
Agricultural sector growth (%)	7.40	7.20	6.30	5.90	5.60	5.90	4.0	4.15
Industrial sector growth (%)	-2.50	-2.20	-3.40	2.0	5.30	1.50	1.20	2.10
Services sector growth (%)	9.20	9.90	10.40	10.80	11.90	12.60	13.90	13.56
Manufacturing capacity utilisation (%)	53.30	53.50	54.70	55.40	55.50	57.0		
Inflation rate (%)	8.20	5.40	11.60	12.50	13.70	10.90	12.20	
Unemployment (%)	13.70	14.60	19.70	21.40	21.40	23.90		
Fiscal balance to GDP ratio (%)	0.50	0.60	0.20	3.30	3.70	-4.40	2.90	
Debt to GDP ratio (%)	12.40	11.70	11.80	15.40	15.40	17.50	19.40	
Average exchange rate	128.7	125.8	118.5	148.90	149.70	153.90	157.50	

(b) Energy Sector Context:

The key objectives of the SE4ALL initiative globally are to ensure universal access to modern energy services; doubling the global rate of improvement in energy efficiency; and doubling the share of renewable energy in the global energy mix by 2030. Beyond Nigeria's natural characteristics described above, the ability to attain the country's SE4All goals depend on the following: resources available, current energy demand and supply, the existing policies and reforms, legal and regulatory regimes as well as the institutional arrangement in place to steer the SE4All development goals.

[3] MDG (2014)
[4] World Bank (2014)
[5] MDG (2014) NBS (various years), CBN (Various years)

(i) Resources

Nigeria is well endowed with resources in both renewable and non-renewable energies which can constitute plausible solutions to address existing energy and in particular power shortages and promote the drive by the Federal Government to increase current installed capacity of the country significantly by the year 2030 and beyond. As it stands, Nigeria's main energy carrier is biomass (81.25%), followed by natural gas (8.2%), petroleum products (5.3%), crude oil (4.8%), hydropower (0.4%), and others (< 1%). Over 50 million metric tons of fuel wood is also consumed annually, especially in rural areas where alternative fuels for cooking are limited or absent.

The Organisation of Petroleum Exporting Countries current rates Nigeria as Africa's largest oil producer with 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 world seventh largest OPEC crude oil producer between 2009 and 2013. Nigeria also exported more than 8% of globally traded liquefied natural gas (LNG from associated petroleum) in 2012 (4th largest producer worldwide). Proven reserves of oil and gas are listed in Table 1; with the current production of fuel, it is expected that 42 years of extraction of oil and 120 years of extraction of gas remain.

Table 2: Overview of Fossil Fuel Reserves, 2012

	Oil	Gas
Reserves	37.2 billion barrels	5.2 trillion cubic metres
Production	2417 thousand barrels	43.2 billion cubic metres
Years of extraction remaining, calculated	42 years	120 years

The country also has strong coal seams in Kogi, Benue, Gombe and Enugu states that have not yet been mined on a large scale, although plans are already in place
with feasibility studies carried out by the Federal Ministry of Power in 2013, nonetheless, the country tends to rely on its fossil fuel resources more than any other form of energy resource. Nigeria is also blessed with other energy sources e.g hydro, solar, wind, biomass, geothermal and marine energy resources.

[6] The Nigerian Energy Sector- an Overview with a Special Emphasis on Renewable Energy, Energy Efficiency, and Rural Electrification (2nd Edition) Nigerian Energy Support Programme GIZ-EU June 2015
[7] Same as in 6 above

(ii) Energy Demand

In the electricity sector, the country's power system is characterized by huge gap between supply and demand; current power demand is estimated at 17,520MW including latent and suppressed demand, against 5,300MW peak generation capability. As a result, about 90 million Nigerians have been reported to have no access to electricity according to (African Progress Report 2015). Out of this non-electrified population, 17 million people live in urban areas, while 73 million live in rural areas. This means majority of the non-electrified live in off-grid areas where grid supply is not economical and may not be sustainable due to high cost of constructing transmission infrastructure.

To this end, the country is targeting at least 10GW by 2020 and 30GW by 2030 of on-grid electricity supply from all energy mix, and another 8GW of off-grid generation by 2030. This target was determined through the process of developing the NREAP and NEEAP as required in the NREEEP 2015. The NREEEP 2015 further required that the energy targets determined during the action plans development process be adopted to replace any earlier targets, including the 115GW grid connected electricity target contained in the NREEEP 2015. In order to achieve this, it is estimated that the country will require investments in power generating capacity alone of at least US$ 3.5 billion per annum. Correspondingly, large investments are also required in the other parts of the supply chain (i.e. the fuel-to-power infrastructure, power transmission and distribution networks).

(iii) Energy Supply

Like in most African countries, the energy sector in Nigeria is characterised by an over exploitation of the forest resources (wood fuel represents more than 80% of total energy consumed), a dependence on imported final petroleum products, and an under exploitation of the potential renewable energy sources (other than biomass). Nigeria is among the leading exporters of crude oil in the world, but it imports about 85% of its refined petroleum products due to low capacity utilisation of its oil refineries (around 65%). The diesel price was deregulated in 2009, which significantly increased the cost of private electricity generation. To date, there are few dedicated

gas only exploration projects, and the gas reserves consist solely of associated petroleum gas. Despite this, Nigeria exported more than 8% of globally traded liquefied natural gas (LNG), making Nigeria the world's fourth largest LNG exporter in 2012. Similarly, in 2012 total Nigerian primary energy supply was 133.7 Million tons of oil equivalent (Mtoe) excluding the electricity trade. The share of biomass and waste was about 80.9%, while natural gas with 9.4%, oil with 5.7%, and hydropower with 0.4%.

[8] The oil and gas sector accounts for just short of 15.0% of GDP, as compared to 79.0% of federal government revenue and 71.0% of export revenues. With an average production of approx. 1,800,000 to 2,100,000 barrels of oil

Table 3 (Energy Balances 2012) below shows that total of 8,440 ktoe of oil and gas products were imported, while 148,201 ktoe were exported. The latter can be subdivided as follows: crude oil totaled 126,413 ktoe; oil products accounted for 755 ktoe and natural gas for 21,032 ktoe. Although Nigeria has vast fossil fuel resources, the majority of the energy consumption relies on biomass energy and waste.

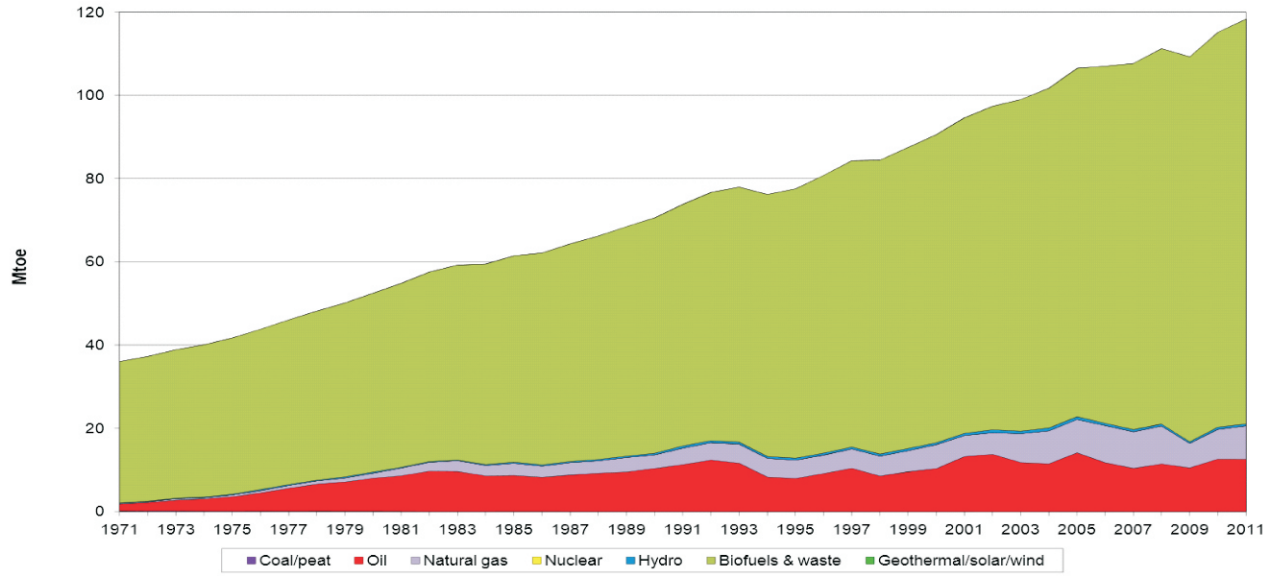
Energy Balances for Nigeria in 2012 (ktoe)	Coal and peat	Crude oil	Oil products	Natural Gas	Hydro	Biofuels and waste	Total
Production	30	129,409	0	33,645	487	108,142	271,712
Imports	0	0	8,440	0	0	0	8440
Exports	0	-126,413	-755	-21,032	0	0	-148,201
International marine bunkers	0	0	-397	0	0	0	-397
International aviation bunkers	0	0	-186	0	0	0	-186
Stock changes	0	1830	538	0	0	0	2368
TPES - 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%

As can be seen from the Figure 2, since the 1970s the reliance on biomass and waste has risen dramatically 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 local refining facilities, and the absence of a pronounced infrastructure for domestic gas utilisation As explained above, present electricity generation in Nigeria is far lower than demand. To date an average of about 75% of the total net generation of Nigerian electricity comes from conventional thermal sources predominantly gas fired power plant, while the remaining 25% come from large hydropower plants. The Transmission System Provider of Nigeria (TSP) is responsible for power transmission across the national grid which comprises of 5,523.8 km of 330 kV and 6,801.49 km of 132 kV of transmission lines. The total licensed on-grid generation capacity in Nigeria is 19,407 MW. Of this figure, 13,308 MW is attributable to the main power plant fleet. However, the highest peak generated ever in Nigeria was 5,074 MW in February, 2016. Transmission losses are between 8 and 10%. The reason for the difference in capacity fleet and peak generation is due to the obsolete state of generating plants.

[8] The oil and gas sector accounts for just short of 15.0% of GDP, as compared to 79.0% of federal government revenue and 71.0% of export revenues. With an average production of approx. 1,800,000 to 2,100,000 barrels of oil per day, Nigeria has been ranked seventh largest OPEC crude oil producer (based on secondary sources) between 2009 and 2013.
[9] GIZ (2015)

Figure 2 : Historical Total Primary Energy Supply (MTOE) 1971-2011[10]

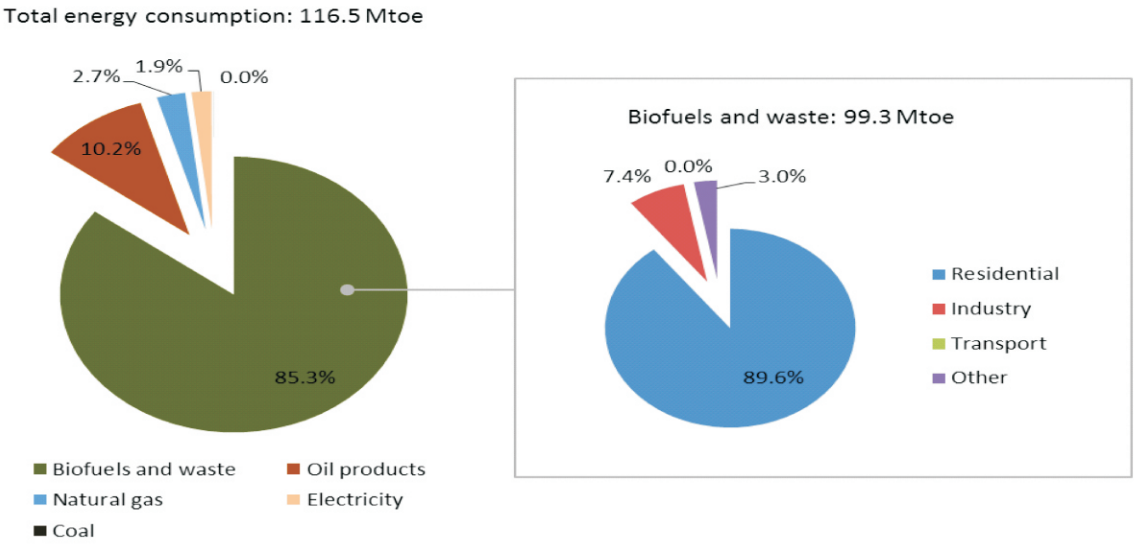


The use of biomass energy is the single largest factor accounting for the change in the country's vegetation cover and the increase in desertification. The rate of fuel wood consumption far exceeds the replenishing rate, thus aggravating the desertification problem. Moreover, the problem will be compounded as the rural population increases in line with the forecast rate of 2.5% p.a. Similarly, in 2012, the residential sector with a share of 78%, accounts for most of the final energy consumption in Nigeria, followed by industrial use at approximately 9%, followed by the rapidly expanding transport sector. As indicated in Figure 2 and 3, 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 residential usage is for cooking purposes, as only this way can the predominant proportion of biofuels and waste be explained. Moreover, oil products used for domestic purposes are minor compared to the level for transport, suggesting that the former utilisation of oil products is presumably attributable to diesel for generating purposes. These patterns therefore suggest that the basic energy requirements in Nigerian households are for lighting, cooking, and energy for household appliances. The form and mix of the requirements depend on various factors including access, availability and affordability of the energy carriers. In terms of household cooking energy, 75% of all consumption comes from solid wood fuel comprising of firewood, charcoal, and crop/ animal waste. Wood is freely available in most rural areas of southern Nigeria but the stock declines as one move up north. For this reason wood is either available at zero monetary cost in some cases, or where there is a price tag, at a relatively low cost compared to other cooking fuels. Wood is undoubtedly a major source of fuel for cooking in many Nigerian homes, both rural and urban. Despite the well-established health and environmental effects caused by continued use of wood for cooking, the desire of the national energy policy (Energy Commission of Nigeria 2003) to promote transition from wood fuel to environmentally benign fuels for cooking may remain impracticable, largely due to poverty and weak policies. Household energy demand is known to be

[10]GIZ 2015

mostly guided by prices of fuels and appliances, disposable income of households, availability of fuels and appliances, and cultural preferences (Dzioubinsky and Chipman 1999; Zhang and Guo 2013). Kerosene and liquefied petroleum gas, LPG, are used in both urban and rural areas of Nigeria for cooking in the households. The price differential of these products makes kerosene the popular choice in many households, and for the fact that kerosene is also more freely available in urban areas and some rural areas. When there is scarcity of kerosene, which happens frequently, the shift is usually towards solid biomass for cooking. The public perception of the risks associated with LPG and its scarcity makes it unattractive for household cooking.

Figure 3 : Energy Consumption by Resources in 2012 (Mtoe) [11]



(iv) The Electricity Sector Reforms

In recent years Nigeria's electricity sector has gone through a major transformation phase, as a result of power sector reforms embarked on by the federal government beginning from 1999 when the country returned to democratic governance. This has led to the enactment of the Electric Power Sector Reform (EPSR) Act 2005 by the national parliament. The unbundling of the Nigerian Electric Power Authority (NEPA). The reform also saw the creation of 18 new successor companies comprising of 6 generation companies, 1 transmission company and 11 distribution companies and an 18 months transition through the establishment of the Power Holding Company of Nigeria (PHCN), and the creation of the Nigerian Electricity Regulatory Commission (NERC) and the Rural Electrification Agency (REA). Companies to carry out the role of bulk trading and liability management were also incorporated as Nigerian Bulk Electricity Trading (NBET) and Nigerian Electricity Liability Management Company (NELMCO); and in August 2012, Transmission System Provider of Nigeria (TSP) was handed over to Manitoba Hydro International of Canada under a 3 to 5 year management contract agreement. Other agencies that result from the power sector reform policy to support the liberalization of the sector include National Power Training Institute (NAPTIN) and Nigeria Electricity Management Services Agency (NEMSA).

The Nigerian electricity sector saw a complete transfer from publicly owned to private sector owned by the end of year 2013.

The main objective of the reform was to reduce the cost of doing business in Nigeria via better management of the electricity industry by the private sector, as well as attracting new private investment in the industry, which could ensure provision of quality and dependable power supply to the economy for industrial, commercial and socio-domestic activities at efficient cost. The reform is further aimed at improving the efficiency of the generation, transmission and distribution networks which is in a comatose state; all these should provide Nigerian citizens with basic and affordable infrastructure to enable them to create employment for themselves. Another key objective of the reform was to create an electricity market that is private sector driven; and attract massive investment across the value chain of the Nigerian Electricity Supply Industry (NESI).

(v) National Energy Policies, Plans and Programmes

Evidence from previous studies indicates that more than thirty (30) draft policy documents have been formulated by various actors in the energy sector. However, only very few of these policy documents have been approved and enforced to date, these include National Electric Power Policy (NEPP), 2002; National Energy Policy (NEP), 2003; Rural Electrification Policy Paper, 2009; Roadmap for Power Sector Reforms, 2010. With specific reference to renewable energy and energy efficiency, the Federal Government of Nigeria in May 2015 approved the National Renewable Energy and Energy Efficiency Policy (NREEEP) as well as the National Determined Contribution (NDC), 2015 which established Nigeria's commitment to greenhouse gas emission. NREEEP seeks to increase the share of on-grid renewable energy in the total electricity supply from its current 1.3% in 2015 to 16% in 2030. However, with the completion and validation of NREAP 2016, this target is now reviewed to 30% renewable energy by 2030. To strengthen these plans, NERC has approved a bankable renewable energy feed-in tariff regulation, and a competitive RE procurement programme is to take-off under the approved bulk power procurement regulation. Also the mini-grid regulation for small scale renewable energy generation is undergoing final consultation before approval. Tariffs methodology for each renewable energy technology will be clearly defined such that investors can pick from a wide range of options available. Additionally, unsolicited projects are being negotiated with

(vi) Legal and Regulatory Framework of the Nigerian EnergySector

As in other countries, the Nigerian Constitution distinguishes between exclusive national, state and local competencies as well as concurrent competencies. Whereas mines, minerals, oil, natural gasand water resources (as well as other related issues as defense, nuclear energy and maritime etc.)are defined as an exclusive competency of the Federal Government, power is a concurrent competency shared between the Federal and State Governments.

[11] GIZ (2015)

The Federal Government has a mandate to regulate power generation and transmission of the national grid. States have also a mandate in power generation; regarding transmission and distribution, their mandate is however confined to off-grid areas. This means that the Constitution does not spell out a clear mandate for distribution within the national grid since it is neither mentioned under the Federal nor State responsibilities. However, some states of the Federation deduct 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. As at 2015 the main legislations guiding the operation of the electricity sector is the EPSR act 2005, other legislation that relate to energy sector as a whole include Petroleum Industry Bill (PIB).

(VII) Institutional Landscape

In terms of policy formulation, the Federal Ministry of Power, Works and Housing (FMP) is responsible for ensuring a robust power sector that fully supports the socio-economic needs of the Nation. The main goal of the Ministry is directed at initiating, formulating, coordinating and implementing broad policies and programmes on the development of electricity generation from all sources of energy. In other words, the Ministry aims to provide the Nation with adequate and reliable power supply by facilitating the implementing of generation, transmission and distribution projects in the sector and facilitating the emergence of a private sector led competitive and efficient electric power industry. FMP is also charged with the responsibility of developing and deploying electricity-related renewable energy policies in Nigeria. While the Federal Ministry of Petroleum Resources (FMPR) is responsible for a robust petroleum sector and acts as the sole Ministry for coordinating and implementing petroleum related policies. Equally, FMPR addresses issues of how the resource supports energy generation and application in the country. Albeit a detailed discussion of the actors in the energy sector of the country indicates that although there seems to be a wide range of actors with varying mandate, public sector institutions (FMP, FME, FMLHUD, FMWR, FMPR, FMST,NNPC, NERC, ECN, SON, NBET, REA, NAEC, NNRA and NPC) clearly dominate the activities of the sector. Private sector institutions (banks and commercial outlets) play a very limited role in driving the sector for now. International organisations on the other hand, though not clearly noticed, play a key role in helping the country align its national energy policy and activities with international best practice

(viii) Energy Sector Regulators:

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, issue licenses to market participants and ensure compliance with market rules and operating guidelines. The Department of Petroleum Resources (DPR) on the other hand acts as the regulator that monitors and regulates the petroleum and gas industry of Nigeria. NESRA was established to regulate environmental issues to check climate

change etc. The Nuclear Safety and Radiation Protection Act No. 19 of 1995 (cap N142 LFRN) established the Nigeria Nuclear Regulatory Authority (NNRA). Since commencing operation in 2001, the NNRA has developed and emplaced effective regulatory control over ionizing radiation sources and practices in the country. The Authority is currently developing the requisite regulations and guidance for NPPs and strengthening the human resource base for exercising regulatory control over the nuclear power programme. Several other agencies are providing various regulatory support services in the energy sectors.

PART 1- VISION AND TARGETS UNTIL 2030

1.1 Nigerian's SE4All Targets For 2030

The Sustainable Energy for All (SE4ALL) Action Agenda of Nigeria is a national implementation tool for the emerging Sustainable Development Goal (SDG) on energy (SDG No. 7). SDG7 on energy underpins progress on other sectors, ranging from health, water and education to gender equality, economic growth and climate action. Its targets are consistent with global and regional SE4All objectives on energy access, energy efficiency and renewable energy. With its huge network of partners across governments, business, international organisations, finance and civil society, Nigeria's SE4All Action Agenda takes a leading role in supporting the implementation of SDG goals in particular SDG7 in the country, and to monitor and report on progress towards the Goal. Through this tool the Nigerian government has demonstrated its commitment in achieving the 3 objectives of the global SE4ALL initiative. The Nigerian power sector has just gone through a transition phase from being publicly owned and controlled to a decentralised private sector driven one. The process was adjudged as one of the most ambitious and transparent processes in the continent. Prior to this, the Nigerian Government had demonstrated the commitment to the Initiative by launching the SE4ALL Nigeria in the year 2012. This singular act placed Nigeria as one of the first Nations in the world to embrace this initiative. Thus, objectives of the SE4ALL initiative is in tandem with the goals of the national energy agenda, which gives high priority to providing access to safe, reliable and affordable energy to citizens in both urban and rural areas. The SE4All initiative requires countries to set quantitative objectives for each of the three goals described in SE4ALL Global Action Agenda 2012. Nigeria's SE4All objectives are therefore defined as follows:

Table 4: Nigeria's SE4ALL Targets

		Targets until 2030
(i)	**Energy Access:**	• To increase electricity access from the current aggregate level of 40% (urban=65%, and rural=28%) in 2015 to 75% (urban= 90%, and rural= 60%) by 2020 • By 2030, the population share living without electricity supplies will drop from the current 60% in 2015 of the total population down to about 10%. • To replace 50% of traditional firewood consumption for cooking by improved cookstove technology by 2020 and 80% by 2030; • Working together with the private sector to roll-out LPG at affordable cost for Nigerians by 2020 and subsequently up to 2030; • By 2025 and 2030, nuclear energy is expected to contribute about 2.5% and 4% to available electricity mix • The electricity generation will increase from the present grid supply of 5000 MW in 2015 to at least 32,000 MW by 2030
(ii)	**Energy Efficiency**	• By the end of 2015, efficient lighting (at least 5 times more efficient than incandescent lamps) will be used by 20% of the households, 40% by 2020 and almost 100% by 2030 • For high -energy consuming sectors (transport, power and industrial sectors), efficient energy technologies will be progressively i ntroduced as well as other demand side management measures such as peak load management when possible. Compared with the current 2015 level, energy efficiency will increase by at least 20% by 2020 and 50% by 2030. • By 2016, energy audits will be compulsory for all high-energy consuming sectors and public buildings

(iii)	**Renewable Energy**	• Nigeria's electricity vision 30:30:30 is to achieve a technology -driven renewable energy sector that harnesses the nation's resources to complement its fossil fuel consumption and guarantees energy security. Specifically, Nigeria's target for renewable energy is: • By 2030, renewable energy is expected to contribute about 30 % share in the available electricity mix; • To achieve a 28% and 19% contribution of hydroelectricity (both large and small hydro) to the nation's electricity generation mix by 2020 and 2030 respectively; • To achieve maintain a 2 % contribution of wind energy to the nation's electricity generation mix by 2020 and 2030 respectively ; • To achieve a 20% and 19 % contribution of solar energy (PV and Solar thermal) to the nation's electricity generation mix by 2020 and 2030 respectively; • To achieve and maintain a 3% power generation capacity using biomass resource by 2020 and 2030 respectively • Achieve 10% biofuel blends by 2020 using locally produced renewable bio - fuel from secondary biomass

1.2 Energy Access Target Until 2030

1.2.1 Access to Electricity Target

Electricity will be a major contributor to the overall supply of modern energy in the country with a total capacity 23.5 GW and 45 GW in 2020, 2030 respectively. As shown in figure 4 below, electricity supply will come from on-grid, off-grid and self-generation. On-grid supply will increase from current level of 26% (2016) to 48% and 70% in 2020 and 2030 respectively, while the use of self-generated power shall decline from the present level of 74% to about 49% and 18% in 2020 and 2030 respectively. Figure 4 also highlighted the overall supply from off-grid systems (mini-grid and solar home systems) to reach 3% and 12% in 2020 and 2030 respectively.

Figure 4: Targets Contribution of Electricity Supply: % On-grid, Off-grid and Self Generation by 2020 and 2030

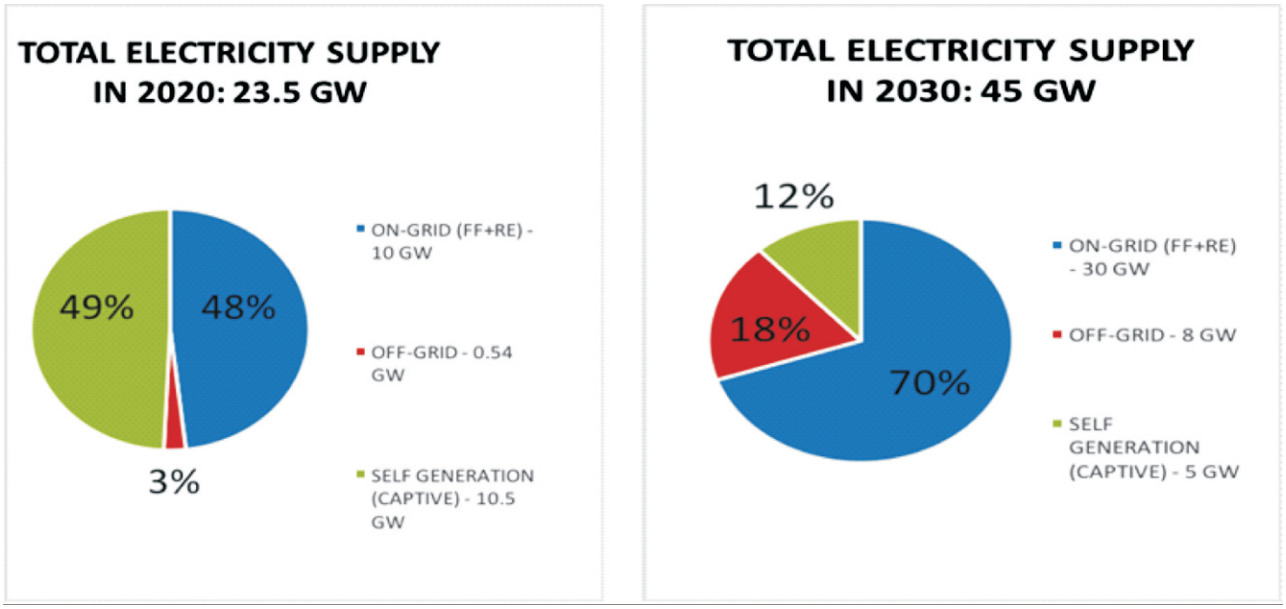


Figure 5: Targets of Electricity Supply in MW until 2030

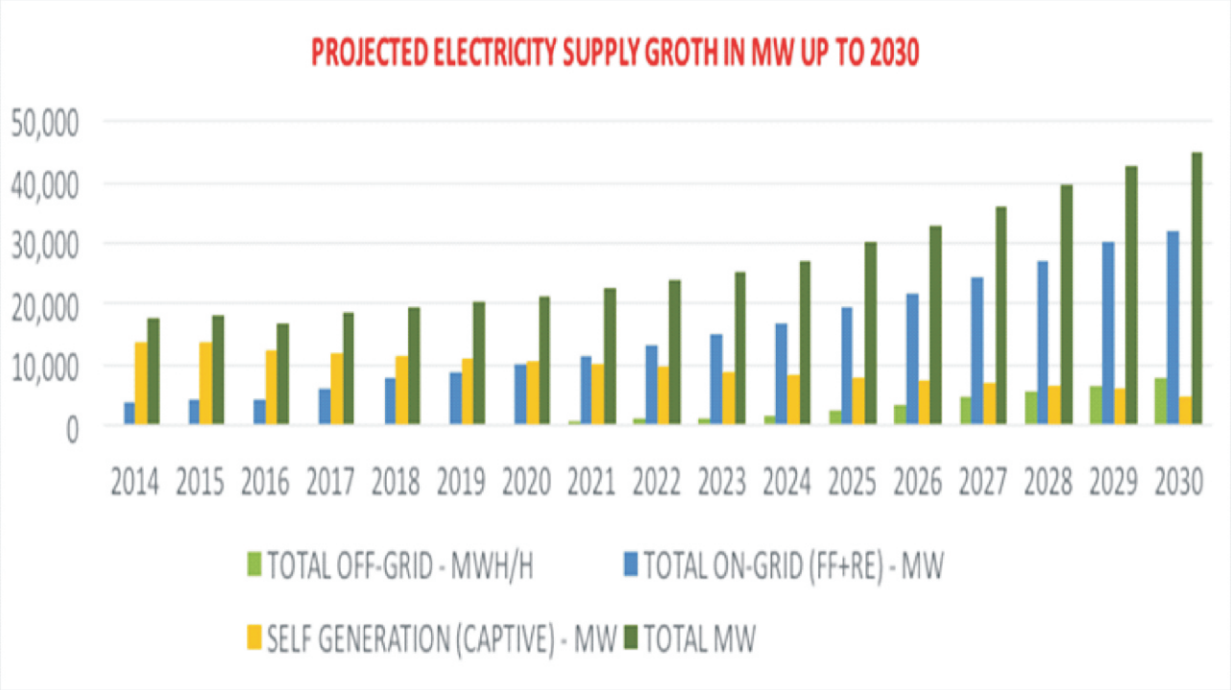
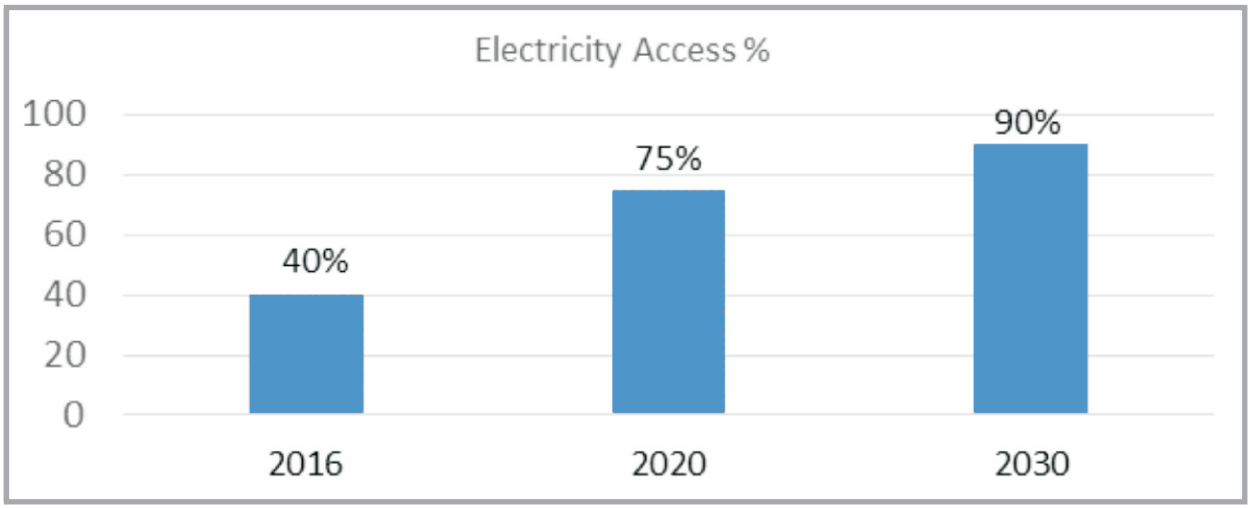


Figure 6: Targets Growth of Electricity Access in Percentage of Population by 2020 and 2030



Source: FMPWH

According to the GTF (2013) Nigeria was ranked among the countries with electricity access deficit. Between 90 - 100 million (60%) people still lack access to electricity and 117.8 million (72%) people are deficit in non-solid fuel access. Thus Nigeria ranks among the high impact countries in this regard.

The Transmission System Provider of Nigeria (TSP) is responsible for power transmission across the national grid which comprises of 5,523.8 km of 330 kV and 6,801.49 km of 132kV of transmission lines.

However, Nigerian electrical power system can be categorized into four basic power generation options[12] - 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. Generation licenses for on-grid power plants capacity amounted to 19,407 MW in 2014, while off-grid licenses cover a production capacity of only 305 MW, embedded generation capacity represents 49 MW, and captive generation covers about 12,500 MW, a capacity much higher than that provided by power plants with off-grid licenses and embedded generators. 13,308 MW installed capacity of the on-grid power plant is attributable to the main power plant fleet (Table 5), 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. NERC's statistics indicates that 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.

Table 5: Existing Nigerian Power Plant Fleet[12]

Name	Fuel Type	Year Completed	Installed Capacity (MW)	Installed available capacity (MW)	Actual generation capacity (MW) as of may 2015
AES	Gas	2001	270	267	0
AFAM IV -V	Gas	1982	580	98	0
AFAM VI	Gas	2009	980	559	523
ALAOJI NIPP	Gas	2015	335	127	110
DELTA	Gas	1990	740	453	300
EGBIN	Gas	1985	1320	931	502
GEREGU	Gas	2007	414	282	138
GEREGU NIPP	Gas	2012	434	424	90
IBOM POWER	Gas	2009	142	115	92
IHOVBOR NIPP	Gas	2012	450	327	225
JEBBA	Hydro	1986	570	427	255
KAINJI	Hydro	1968	760	180	181
OKPAI	Gas	2005	480	424	391
OLORUNSOGO	Gas	2007	335	244	232
OLORUNSOGO NIPP	Gas	2012	675	356	87
OMOKU	Gas	2005	150	0	0
OMOTOSHO	Gas	2005	335	242	178
OMOTOSHO NIPP	Gas	2012	450	318	90
RIVERS IPP	Gas	2009	136	166	0
SAPELE	Gas	1978	90	145	81
SAPELE NIPP	Gas	2012	45	205	116
SHIRORO	Hydro	1989	60	480	350
ODUKPANI	Gas	2013	56	70	0
Total			**12,067**	**6,840**	**3,941**

The existing fleet of power plants (Table 5) 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 is just under 6,200 MW. 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, only between 3,000 MW to 4,600 MW are actually being generated as shown in Table 6. The highest peak generated ever in Nigeria was 5,074 MW in February, 2016. Up to 2 700 MW of power generation capabilities are regularly lost due to gas shortage, up to 500 MW are lost due to water management, while several hundred megawatts are regularly lost due to line constraints, thus transmission losses are between 8 and 10%

Table 6: Electricity Generation Profile

Year	Ave. Gen. availability (MW)	Maximum peak generation (MW)	Maximum daily energy generated (MWh)	Total energy generated (MWh)	Total en ergy sent out (MWh)	Per Capita Energy Supply (kWh)
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

Albeit, the current fleet capacity and electricity generation profile enumerated above are still way below the FMPWH (table 7 and 8) Electricity Vision 30:30:30 demand projections for the country. Currently, final consumption or use of energy for electricity in Nigeria for grid-supplied electricity consumption per sector is skewed towards the residential sector. Reasons to explain the difference revolve around the fact that the industrial sector will prefer to pay for grid connected electricity as opposed to diesel own-generated electricity. The latter is more expensive than the former (GIZ 2015; Ibitoye 2013; Oyedepo 2013). Relying on available grid capacity is grossly inadequate - businesses and households alike suffer from outages regularly. Similarly, it is estimated that between 8 and 14

[12] The Nigerian Energy Sector- an Overview with a Special Emphasis on Renewable Energy, Energy Effi ciency, and Rural Electrification (2nd Edition) Nigerian Energy Support Programme GIZ -EU June 2015

GW of decentralised diesel generator capacity is currently installed in the country. Nigeria leads Africa as a generator importer, as none are produced locally, and is one of the biggest importers worldwide, the total annual import figure being Naira (N)17.9 billion. Nearly every company, or 85%, has its own diesel generator. In 2011, 60 million power generator appliances were in operation or one per every 2.5 members of the population. In this context, Nigerian manufacturers, small scale businesses and families spend on average of N 3.5 trillion per year to power their generating sets with diesel and petrol due to unstable supply of electricity. Among private households, the figure is N 1.56 trillion ($13.35b). The signal difference between corporations and homes is that manufacturers pay a lower diesel price of only between N 45 and N 60/kWh, while households pay between N 50 and N 70/kWh (GIZ 2015).

Table 7: Electricity Vision 30-30-30 Capacity Growth Projection (MW)

ELECTRICITY VISION: 30 30 30

EOY	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ON-GRID CAPACITY - MWH/H																	
Fossil Fuel (FF)																	
Gas	2,800	3,076	3,121	3,913	4,172	4,259	4,524	4,867	5,286	5,889	6,684	7,581	8,646	9,714	10,957	12,429	13,000
Coal	0	0	0	0	0	255	424	628	871	1,060	1,203	1,408	1,582	1,958	2,388	2,846	3,200
Nuclear	0	0	0	0	0	0	0	0	0	0	0	1000	1000	1000	1500	1500	2000
Sub Total FF	2,800	3,076	3,121	3,913	4,172	4,514	4,948	5,495	6,157	6,949	7,887	9,989	11,228	12,672	14,845	16,775	18,200
Renewables (RE)																	
LHP	916	1,097	1,200	1,650	1,920	2,200	2,540	2,800	3,100	3,400	3,700	4,000	4,200	4,500	4,600	4,700	4,700
SMHP	0	15	45	125	205	285	265	325	405	485	565	625	705	785	865	945	1,200
Solar PV	0	0	100	500	1,200	1,600	2,000	2,300	2,600	2,900	3,200	3,500	3,840	4,180	4,520	4,860	5,000
Solar Thermal	0		0	0	0	0	50	200	300	400	500	600	700	800	900	950	1,000
Wind (Max)	0	0	10	50	90	130	170	210	250	290	330	370	450	530	610	750	800
Biomass	0	0	0	50	180	240	300	360	420	480	540	600	720	840	960	1,080	1,100
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total RE plus LHP	916	1,112	1,355	2,375	3,595	4,455	5,325	6,195	7,075	7,955	8,835	9,695	10,615	11,635	12,455	13,285	13,800
Sub Total RE less LHP	0	15	155	725	1,675	2,255	2,785	3,395	3,975	4,555	5,135	5,695	6,415	7,135	7,855	8,585	9,100
% RE plus LHP	25	27	30	38	46	50	52	53	53	53	53	49	49	48	46	44	43
% RE less LHP	0	0	3	12	22	25	27	29	30	31	31	29	29	29	29	29	28
TOTAL ON-GRID (FF+RE) - MWH/H	3,716	4,188	4,476	6,288	7,767	8,969	10,273	11,690	13,232	14,904	16,722	19,684	21,843	24,307	27,300	30,060	32,000
OFF-GRID CAPACITY - MWH/H																	
Mini-Grid	1	1	5	50	125	150	180	270	405	608	911	1,367	2,050	3,075	3,691	4,429	5,314
SHS + Street Lights	10	30	50	100	150	300	360	540	648	778	933	1,120	1,344	1,612	1,935	2,322	2,786
TOTAL OFF-GRID - MWH/H	11	31	55	150	275	450	540	810	1,053	1,385	1,844	2,487	3,394	4,688	5,625	6,751	8,101
SELF GENERATION (CAPTIVE)	13,800	13,800	12,500	12,000	11,500	11,000	10,500	10,000	9,500	9,000	8,500	8,000	7,500	7,000	6,500	6,000	5,000
GRAND TOTAL - MWH/H	17,527	18,019	17,031	18,438	19,542	20,419	21,313	22,500	23,785	25,290	27,067	30,170	32,737	35,995	39,426	42,811	45,101

30GW BY 2030 WITH 30% RENEWABLE ENERGY

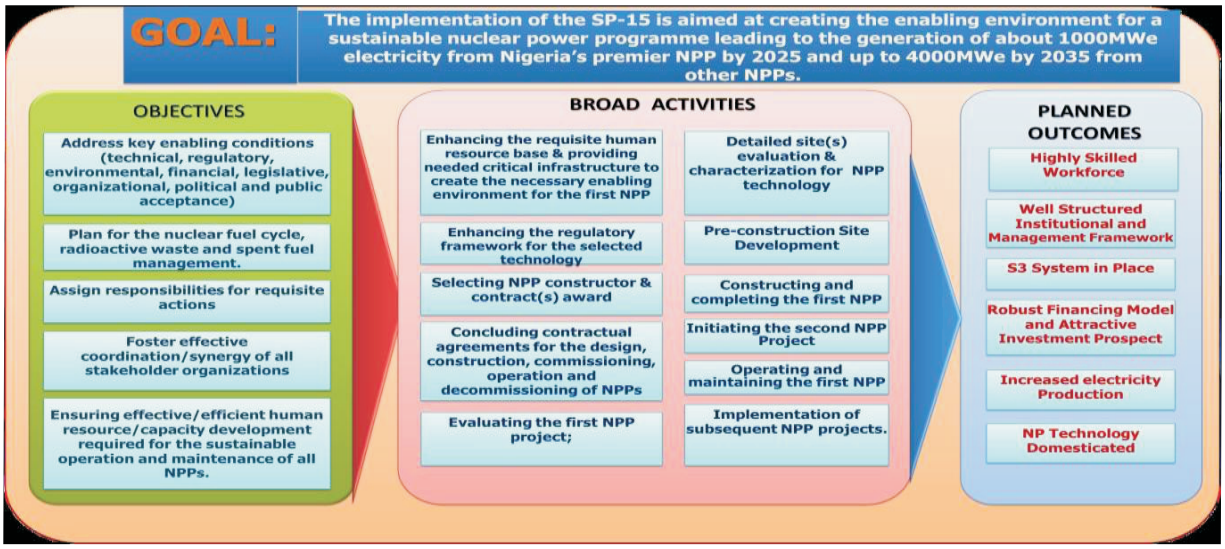
Table 8: Electricity Vision: 30-30-30 Energy Delivery Projections (GWH)

ELECTRICITY VISION: 30-30-30																	
EOY	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
ON-GRID CAPACITY - GWH																	
Fossil Fuel (FF)																	
Gas	18,386	20,198	20,494	25,696	27,397	27,967	29,708	31,956	34,710	38,672	43,893	49,777	56,774	63,787	71,951	81,616	85,363
Coal	0	0	0	0	0	1,674	2,784	4,124	5,719	6,960	7,899	9,245	10,388	12,857	15,681	18,688	21,203
Nuclear	0	0	0	0	0	0	0	0	0	0	0	7,776	7,776	7,776	11,664	11,664	15,552
Sub Total FF	18,386	20,198	20,494	25,696	27,397	29,641	32,493	36,080	40,429	45,633	51,792	66,798	74,938	84,420	99,296	111,968	122,118
Renewables (RE)																	
LHP	4,749	5,687	6,221	8,554	9,953	11,405	13,167	14,515	16,070	17,626	19,181	20,736	21,773	23,328	23,846	24,365	24,365
SMHP	0	78	233	648	1,063	1,477	1,374	1,685	2,100	2,514	2,929	3,240	3,655	4,069	4,484	4,899	6,221
Solar PV	0	0	164	821	1,970	2,627	3,283	3,776	4,268	4,761	5,253	5,746	6,304	6,862	7,420	7,978	8,208
Solar Thermal	0		0	0	0	0	151	605	907	1,210	43,272	1,814	2,117	2,419	2,722	2,873	3,024
Wind	0	0	23	117	210	303	397	490	583	677	770	863	1,050	1,236	1,423	1,750	1,866
Biomass	0	0	0	276	995	1,327	1,659	1,991	2,322	2,654	2,986	3,318	3,981	4,645	5,308	5,972	6,083
Geothermal	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Sub Total RE plus	4,749	5,765	6,642	10,416	14,191	17,139	20,031	23,061	26,251	29,441	74,391	35,717	38,879	42,560	45,204	47,836	49,766
Sub Total RE less	0	78	421	1,862	4,238	5,734	6,864	8,546	10,181	11,815	55,210	14,981	17,106	19,232	21,357	23,471	25,402
% RE plus LHP	21	22	24	29	34	37	38	39	39	39	59	35	34	34	31	30	29
% RE less LHP	0	0	2	5	10	12	13	14	15	16	44	15	15	15	15	15	15
TOTAL ON-GRID (FF+RE) - GWH	23,134	25,963	27,135	36,111	41,588	46,780	52,523	59,141	66,680	75,073	126,183	102,515	113,817	126,980	144,499	159,804	171,885
OFF-GRID CAPACITY - GWH																	
Mini-Grid	1	2	9	864	2,160	2,592	3,110	4,666	6,998	10,498	15,746	23,620	35,429	53,144	63,773	76,528	91,833
SHS + Street Lights	17	52	86	173	259	518	622	933	1,120	1,344	1,612	1,935	2,322	2,786	3,344	4,012	4,815
TOTAL OFF-GRID - MW	18	54	95	1,037	2,419	3,110	3,732	5,599	8,118	11,841	17,359	25,555	37,751	55,930	67,116	80,540	96,648
SELF GENERATION (CAPTIVE) - GWH	90,616	90,616	82,080	78,797	75,514	72,230	68,947	65,664	62,381	59,098	55,814	52,531	49,248	45,965	42,682	39,398	32,832
GRAND TOTAL -	113,769	116,633	109,310	115,945	119,521	122,121	125,203	130,404	137,179	146,012	199,356	180,601	200,816	228,875	254,297	279,742	301,364
Real Per Capita (kWH)	136	145	143	191	221	245	269	302	341	386	622	541	625	736	831	920	1,003
Per Capita (kWH) including Self Generation	**669**	**648**	**574**	**597**	**601**	**599**	**599**	**609**	**625**	**649**	**864**	**763**	**828**	**921**	**998**	**1,071**	**1,126**
Population Growth (Million) at 2% Ave Rate	**170.00**	**180.00**	**190.34**	**194.15**	**199.00**	**203.98**	**209.07**	**214.30**	**219.66**	**225.15**	**230.78**	**236.55**	**242.46**	**248.52**	**254.74**	**261.11**	**267.63**
30GW BY 2030 WITH 30% RENEWABLE ENERGY																	

1.2.1.1 Nuclear Energy Targets Until 2030

The Nigeria Atomic Energy Commission (NAEC) serves as the pivotal promotional institution to provide the technical leadership for the planning and deployment of the first nuclear power plants (NPPs) to generate electricity in the country. NAEC, as mandated by its enabling Act, has developed the requisite National Nuclear Power Roadmap, referred to as the "Technical Framework (TF)". The TF was approved by Federal Government of Nigeria (FGN) in February, 2007, and the "Strategic Plan for the Implementation of the approved National Nuclear Power Programme", referred to as the"Strategic Plan 2009 (SP-09)" was finalized and approved in December, 2009. The revised edition, (SP-15)" was successfully finalized in April, 2015 and has the goal to ensure the availability of at least 1000 MW of electricity generation from the first NPP by 2025 and an additional 3000 MW from more NPPs into the national grid by 2035. The SP-15 therefore identifies the technical, regulatory, and institutional gaps and issues that need to be addressed for the premier nuclear plant to be deployed in the country in this timeframe. In order to meet SP-15 goal, key programme elements must be addressed and a meticulous implementation of the strategic plan will produce planned outcomes as depicted in figure 6.

Figure 7: Planned Outcomes of the Strategic Plan



1.2.2 Clean Cookstoves

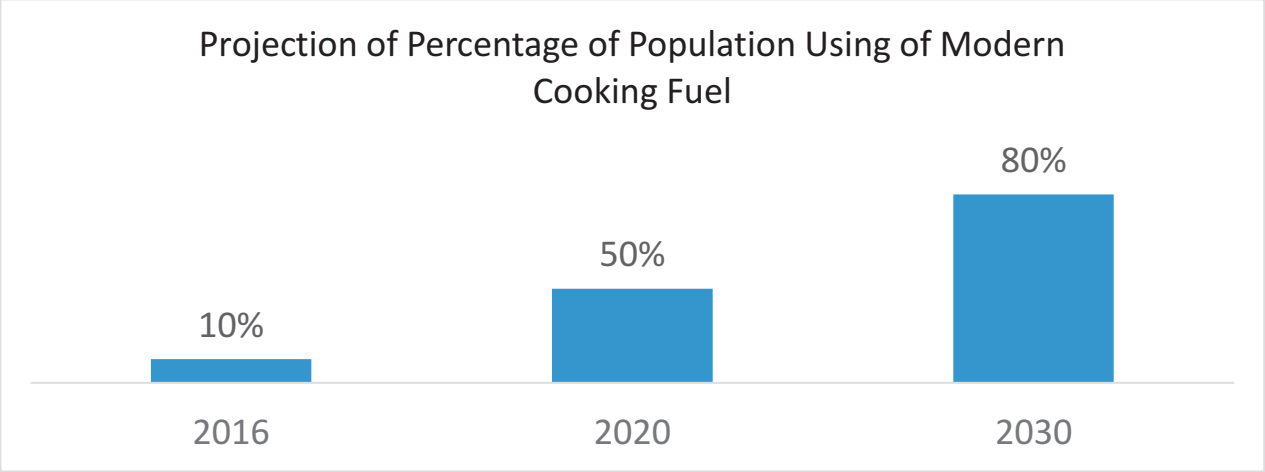
According to ECREEE's 2015 estimate, about 80% of the ECOWAS population still uses traditional biomass for cooking. This is mostly done in an inefficient manner, making children and women vulnerable to health problems which sometimes result into death. Nigeria is not left out of this problem as over 75% of the Nigerian population

[13] http://www.ecreee.org/page/west-african-clean-cooking-alliance-wacca

especially in the rural areas still deploys the traditional cooking method of using wood fuel. In order to address this, ECREEE initiated a regional clean cooking initiative the West African Clean Cooking Alliance (WACCA). The overall aim of the initiative is to provide safe, sustainable and affordable cooking for the ECOWAS region, and specifically by 2030, ensure that the entire ECOWAS population has access to efficient, sustainable and modern cooking fuels and devices.

Similarly, the Global Alliance on Clean Cookstoves (GACC)- Nigeria is also working in partnership with the International Centre for Energy and Environment Development (ICEED), the Federal Ministry of Environment and other relevant Agencies and NGOs to promote clean cooking in Nigeria (see PART 2 of this AA for further details).

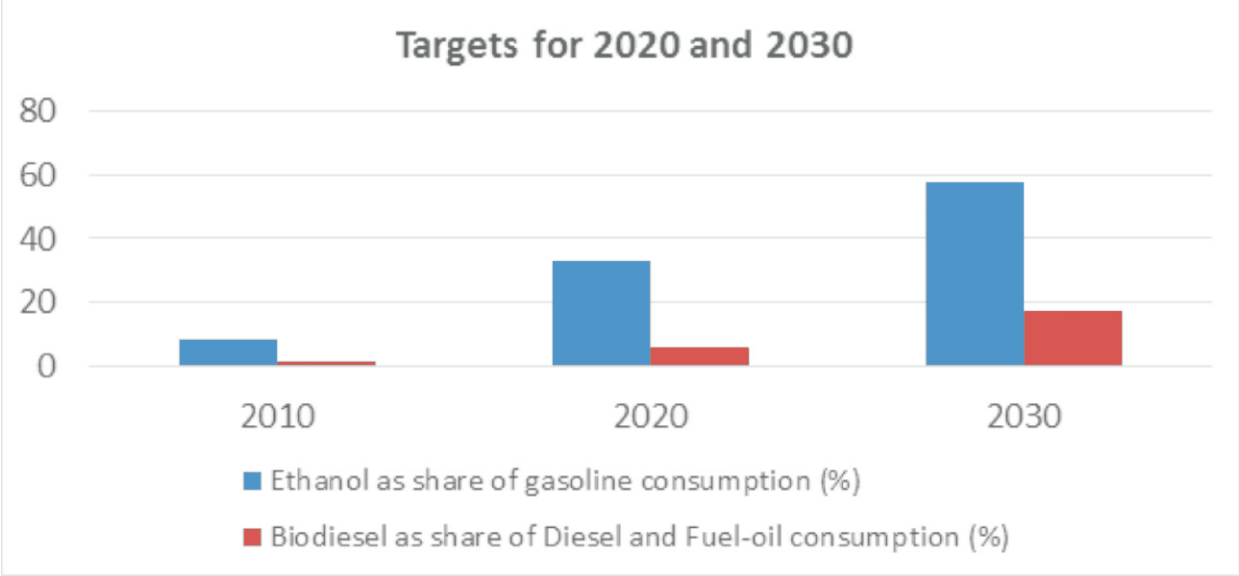
Figure 8: Target of % Population using Modern Cooking Fuels by 2020 and 2030



Source: Federal Ministry of Environment 2015

The use of modern cooking fuels such as electricity, LPG, kerosene, biogas and solar cookers will increase significantly under the energy access target, raising from the current estimate of 10% to 50% by 2020 and reach 80% of the population in 2030. Improved wood cooks stove as well as efficient charcoal production will provide the balance of 20% population with cooking fuels in households. Details of contribution from each cooking fuel is contained in the National Renewable Energy Action Plan (NREAP) 2016.

Figure 9: Targets of Biofuels for 2020 and 2030

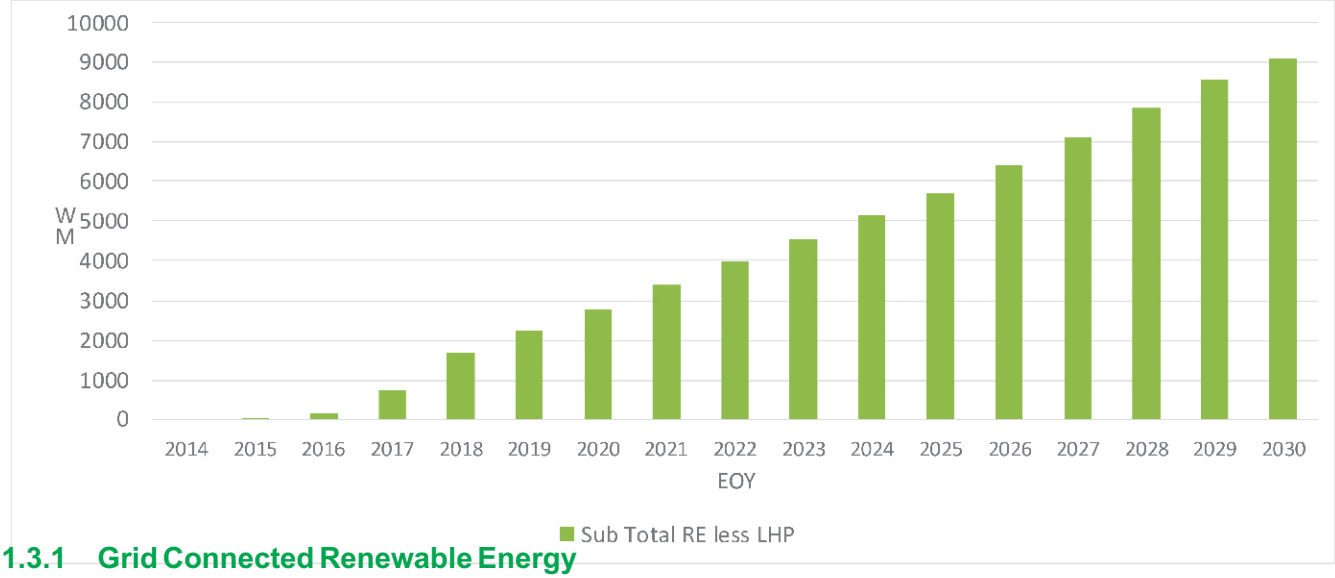


Source: NNPC 2015

1.3 RENEWABLE ENERGY TARGET UNTIL 2030

Renewable energy utilisation in Nigeria is becoming a top priority on the policy agenda. Before now renewable energy utilization is limited to large hydro power which contribute about 20% of the electricity mix. However, at present a lot of attention is given to other renewable energy resource development such as solar, wind, small hydro and biomass. The total share of new renewable energy in total energy and electricity mix is still very low, but this is expected to increase as the gains from the recent power market reforms starts to trickle in. Recently, NBET signed PPAs to procure 1,200 MW of solar power at the rate of 11.5 US cents/kWh expected to come online by 2018. Nigeria has a target of 5,300 MW and 13,800 MW of on-grid renewable energy capacity by 2020 and 2030 respectively (including Large hydro power). Also, a target of 2,700 MW and 9,100 MW of on-grid renewable energy (excluding large hydro power) in 2020 and 2030 respectively. This means approximately 30% of renewable energy contribution to on-grid generation capacity by 2030.

Figure 10: Targets of Renewable Energy Growth (less LHP) by 2030



1.3.1 Grid Connected Renewable Energy

Renewable energy deployment in Nigeria is still at its infancy stage. Apart from hydropower no grid connected capacity has been installed yet; however, plans are in place to have grid connected renewable energy power from 2017 on. One of the reasons that explain this is the lack of policies and regulatory framework that drives the sub-sector in the past. Large scale implementation process of renewable energy requires strategies that allow for a number of factors including priority or target setting, policy continuity and a clear focus on key issues. Accordingly, such strategies should be based on realistic targets, a defined time frame as well as effective target evaluation. Using the energy demand and supply projections of the Electricity Vision 2030, the following targets are presented:

Figure 11: Capacity Growth for On-grid Power up to 2030

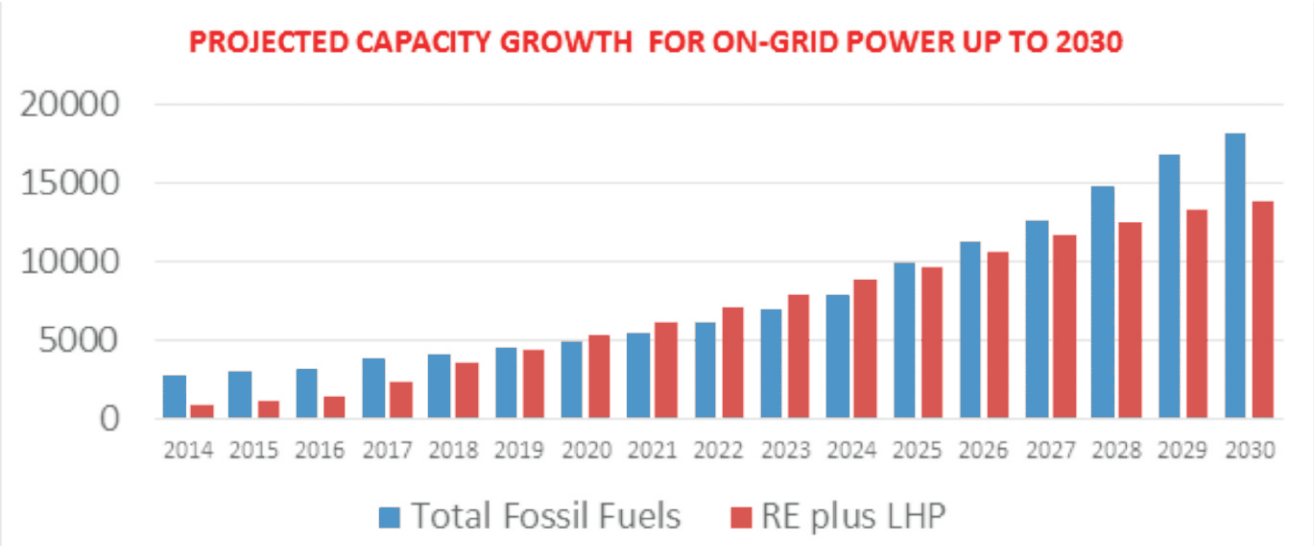
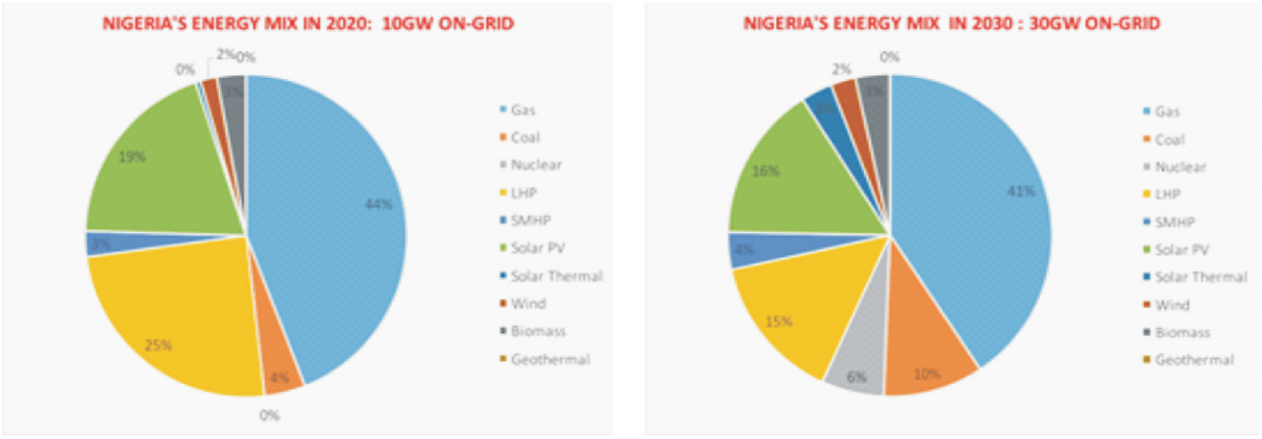


Table 9: Summary of Renewable Electricity Targets

S/N	Resource	2010	Short Term	Medium Term	Long Term (2030)
1	Hydro (LHP) (MW)	916	1097	2,540	4,700
2	Hydro (SHP) (MW)	0	15	265	1,200
3	Solar (MW)	0	0	2,050	6,000
4	Biomass (MW)	0	0	300	1,100
5	Wind (MW)	0	0	170	800
	All Renewables plus LHP (MW)	916	1,112	5,325	13,800
	All Energy Resources (On-grid power plus MW of self- generated power)	18019**	18,019**	21,313**	45,101**
	% of RE incl. LHP	5%	27%	52%	46%
	% of RE excl. LHP	0%	0.01%	27%	30%

**Supply projections are based on the addition of on-grid power, and a base capacity of 13,800 MW of self-generation in 2015; 10,500 MW in 2020, and 5000MW by 2030 (i.e. power generated for own use) including off-grid generation.

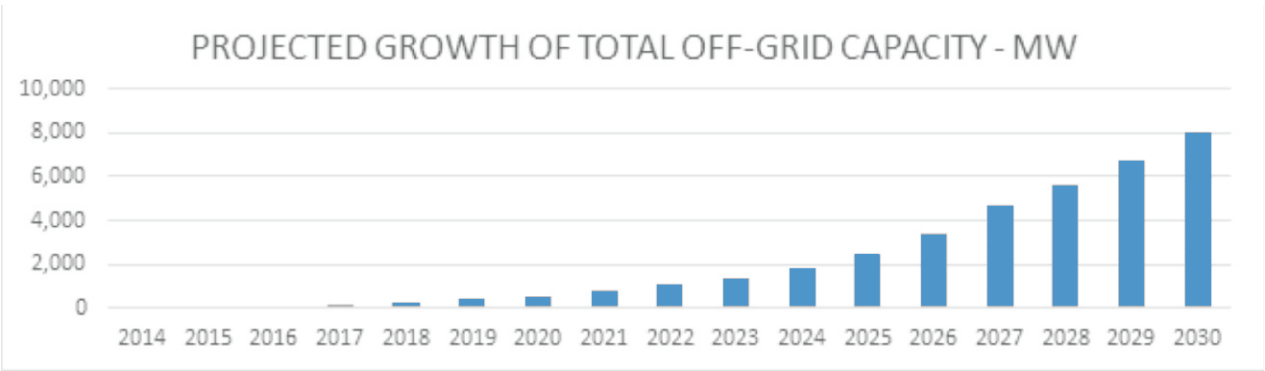
Figure 12 : Target of Nigeria Energy Mix in 2020 and 2030



1.3.2 Off-Grid Renewable Energy Targets

The Federal Government of Nigeria has established the Rural Electrification Agency (REA), an agency dedicated to support rural electrification programmes in Nigeria and backed by the EPSR Act 2005. The agency will provide both financial and technical support to developers of off-grid renewable energy projects of priority. The draft Rural Electrification Strategy and Implementation Plan (RESIP) 2015 which will guide the operations of the REA pointed out clearly that *"for remote settlements, mini- grid solutions are often found to be more cost- effective than grid extension. In some particular cases where the level of demand and population density is relatively high, mini-grids (with either fossil fuel or renewable resource-powered generation technology) may be the most technically and economically viable approach to providing rural electricity".* Currently, about 51% of Nigerian population lives in rural areas and are far away from the National Grid. It is estimated that 70,000,000 people (approximately 72%) lack access to reliable electricity supply in the rural areas. Thus, renewable energy technologies both in terms of PV mini-grids and solar homes systems, biomass solutions, and small hydro solutions are key to meeting the electricity demand of this group of the Nigerian population and are expected to play a key role in enabling the government to reach these set targets.

Figure 13 : Growth of Off-grid Capacity (MW) up to 2030



1.3.2.1 Planned Off-grid Renewable Energy Solutions/Projects

In January 2014, the Federal Ministry of Power unveiled a national programme called the Operation Light-Up Rural Nigeria (OLRN) as an off-grid renewable energy intervention programme. The Light-up initiative was developed by the ministry to provide electricity access to rural communities that are far from the national grid. Pilot projects in Durumi, Waru and Shape communities in the FCT, Abuja were commissioned on January 13, 2014 by the last Administration. The pilot projects were executed by the Ministry of Power in collaboration with Schneider Electrics of France and Philips Electronics of the Netherlands. The pilot project will be replicated across the country and will be expanded to include private sector financing through a 'Build, Own and Operate' (BOO) model. To further fine-tune the model, The Federal Ministry of Power is currently working with the Golden Grid Solutions Inc. to present the Renewable Energy Micro-Utilities (REMU) For Off-Grid Villages in Nigeria. The REMU is a sustainable platform for economic empowerment, and universal access for areas where off-grid solutions are appropriate. The REMU will help cut down on the current 41 million people without electricity access in Nigeria. REMU also takes a step further from other rural electrification models. The model utilises wireless devices for micro-utility systems. A layer of software is also added into the system making it secure, standard, mobile base power transaction system, thus making it smart, flexible and expandable.

Similarly, the rural electrification component of the GIZ's Nigeria Energy Support Programme (GIZ- NESP 2013 to 2017) is partnering with 5 states of the Federation (Sokoto, Niger, Plateau, Ogun, and Cross River) on a rural electrification scheme which will be developed by private investors for sustainability purposes. A Call for Expressions of Interest to develop 10 projects that will provide electricity for 10 000 people has been launched in July 2015; the first projects will be commissioned in the second half of 2016. The World Bank is also undertaking a similar exercise for the Kano and Enugu DisCos. Ultimately, this should lead into a National Electrification master Plan. Also, the Japanese Government has executed some of the most notable on-grid rural electrification projects in Nigeria under their Grant-In-Aid programme implemented by JICA.

1.4 ENERGY EFFICIENCY TARGETS UNTIL 2030

As the case is with other West African countries, discussions on energy efficiency in Nigeria have just started receiving significant attention from both the public and private sectors of the country hence, it is currently difficult to set any detailed energy efficiency target for Nigeria. As outlined in SEFA Nigeria (2012), the limited energy supplied in Nigeria is wasted through the use of old, obsolete and inefficient appliances as well as inefficient habits of energy users. Nevertheless, there is scope for potential high energy savings especially in four main demand sectors- household, industry, public sector services and transportation. The potential has remained untapped due to inadequate human capacity, low level of awareness; lack of coordinated research and absence of energy efficiency testing laboratories. Other challenges identified in the Rapid Assessment also include the absence

laboratories. Other challenges identified in the Rapid Assessment also include the absence of Minimum Energy Performance Standards (MEPS) for appliances and products, low institutional capacity and lack of funding. A stock taking in the ECOWAS community in 2013 indicated that 30% savings of electricity are feasible in the region by economically viable energy efficiency measures. The targeting of energy efficiency as a national goal can hence lead to new commercial and economic opportunities beyond traditional energy. Products such as efficient solar powered stoves and refrigerators, natural gas furnaces for industries, solar ground water pumps, efficient lighting technologies and smart meters represent new product opportunities. A recent study conducted by GIZ in 2014 on the Nigerian Energy Sector found that with the exception of the UNDP/GEF programme currently undertaken in the country, measures in the sense of centrally planned or coordinated programmes are not yet in place. Albeit the following are the overarching targets set for year 2020 and 2030

- **By 2020**
  - Efficient lighting will be used by 40% of the households
  - For high-energy consuming sectors (transport, power and industrial sectors), efficient energy will increase by at least 20% compared to baseline
  - Achieve 10% biofuel blends
  - Improve the efficiency of the bioenergy sector
  - Distribution loss reduction target to 15-20%

- **By 2030**
  - Efficient lighting will be used by almost 100% of the households
  - For high-energy consuming sectors (transport, power and industrial sectors), efficient energy will increase by at least 50% compared to baseline
  - Curb the firewood demand below supply capacity
  - Distribution loss reduction target to less than 10%

Table 10: Planned Energy Efficiency Projects

Project	Scope
Abuja Green City	The Abuja Green City is an initiative of the Renewable Energy Programme of the Federal Ministry of Environment, together with Green Carbon Afrique Creation Environmental Services and Integra Integrated Renewable Energy Services. The low - carbon housing development is using a combination of local electricity generation, improved insulation, and energy efficient devices for the apartments.
Abuja Centenary City	Being planned by an investor from the Gulf and designed by Julius Berger Internation al, this city will feature an array of sustainable measures, renewable energy sources, and energy - efficient mechanisms.
Nigerian Clean Cookstoves Design and Testing Centre	With support from the Global Alliance for Clean Cookstoves, the International Centre for Energy, Environment Development (ICEED) is establishing the Nigerian Clean Cookstoves Design and Testing Centre at Afikpo, Ebonyi State. The centre will provide stove producers and users, and other relevant stakeholders with the opportunity to confidently compare stove performance and safety. In addition, it will provide a common set of terminology for wood stoves for easier understanding and communication, and; give stove producers, marketers and users assurance of product quality.
The Nigerian Clean Energy Access Program (NCEAP)	NCEAP is part of FMENV's initiative to ensure energy efficiency is driven by the private sector and plans to distribute 150 million LED bulbs over the next five years under the Clean Development Mechanism (CDM).
GIZ - Nigerian Energy Support Programme	The Nigerian Energy Support Programme (NESP) in cooperation with the FMP, FMLHUD and the FMITI inter alia focuses on energy efficiency in the building and industrial sector. Pilot projects will be implemented for apartment buildings, for the application of solar water heaters and with regard to energy management systems in selected industries. Experiences are used for up - scaling into policy development and the development of support mechanisms such as financing schemes, introduction of ISO standards and standards and labels for household appliances.

The Energy Efficient Housing Scheme	This scheme is a partnership between the Federal Ministry of Environment and Aso Savings and Loans Plc, a leading mortgage bank, Kaduna State Government, and Green Carbon Afrique, who are the lead investors partnering with EMEL Group. The objective is to deliver affordable energy efficient housing for staff of the Ministry by way of a flagship in order to foster growth. Some 40% of the energy efficient units are pre-fabricated homes and the housing scheme is designed to incorporate micro generation of electricity from renewable sources, mainly solar and biomass (the waste produced within the estate). The models of energy efficient electrical components ensure that residents of the new estate benefit from lower electricity bills. The Energy Efficient Housing project as launched in Kaduna will initially focus on 2,000 housing units and many more are on the pipeline from different states across the nation.
National Building Code	The FMPWH is working with other Ministries, professional bodies and development partners to develop new building code and considers the importance of integrating energy efficiency measure and designs in buildings in Nigeria.

1.5 RELEVANT NEXUS TARGETS UNTIL 2030

Energy is an enabler of sustainable development for all countries and all people irrespective of their race, culture, and tradition. It is an asset within the framework of good governance in building infrastructure for sustainable development. Energy sources are vital for alleviating poverty, improving human welfare and in raising living standards. If provided adequately, they could lead to significant economic growth that allows countries to achieve their development goals. Weak linkages between energy and other sectors could impose costs on future development targets, with unbearable consequences for livelihood and economic development. This is very important even as the country electricity sector is undergoing great transformation from the publicly- owned sector to the private sector.

Table 11 : Energy- Other Sector Nexus Targets

NEXUS ISSUE	CONTEXT	TARGETS & MEASURES
Health and Environment	Electricity needs of community health Indoor air quality Cooking	Extending the RUWES initiative of the Federal of Environment to all parts of the country reducing indoor air pollution by 70% by 2030. Putting in place international quality improved cook stove used in Nigeria; Carrying out a nation-wide campaign on methods for cooking and how to create ventilation for improving air quality in locations traditional cookstoves are still being cooking; Electrifying up to 90% of community health care in Nigeria by 2030.
Water and Food Security	Improved water and supply Food processing	Using improved modern energy supply to overall water supply of 90% to the Nigerian by 2020 and 100% by 2030; Cut down post -harvest damages of crops by 2030 through the creation of free processing zones in all strategic locations country.
Society and Education	Time spent on collection Electricity need community schools	Reduce to minimal level the amount of time rural women in collecting firewood by 2030; Engage in national campaign to sensitise utilizing time gained for adult learning opportunity for training on use of improved and healthy living lifestyle; Provide electricity access and basic energy about 95% rural and semi-urban educational e.g. schools by 2030

PART II- PRIORITY ACTION AREAS

2.1 ENERGY ACCESS

2.1.1 Current Status and Trajectory

The revised draft of the National Energy Policy 2003 observed that with the exception of the upstream oil and gas sub-sectors, and to a smaller extent the electricity sub-sector, government had been largely responsible for the ownership and operation of the energy sector industries. In particular, investment capital in the past (pre 2010) had been sourced from public funds. This resulted in the progressive deterioration of existing facilities and no new capacity added despite the increase in demand. Funding and management deficiencies had also given rise to inadequate and unreliable supply, especially of electricity and petroleum products, insecurity of the energy supply system and loss of productivity. Increased private sector participation in the energy sector will attract new investments to the

sector, while the profit motive will assist in solving much of the management problems experienced under public ownership. This restructuring of the sector will involve both deregulation and privatisation.

In this report Nigeria's average power consumption is estimated at 143 kWh/year per capita (Table 8). Although this figure seems to be higher than some Sub-Saharan African countries, Nigerian electricity grid supply lagged behind that of similar emerging economies/countries. Core reasons that explain this revolve round the fact that, over 50 percent of the electrical energy consumed in the country is estimated to be currently produced off-grid by diesel and gasoline generators of all shapes and sizes. Unmet demand is also high, particularly amongst the many citizens who have no access to the grid and cannot afford off-grid power. As a result, Nigeria's per capita consumption is still largely skewed towards non-productive use. Hence, the recent privatisation was embarked upon not only to improve the energy access target of the country by year 2020 and beyond but also to promote power for productive uses. An annual investment of USD ($) 3.5 billion will be required from both the private and the public of the country to make this a reality. Based on NPC 2016 population figure of 193.4 million and with an annual population growth rate of 2% it is expected that the country's population will reach 267 million by 2030 (Table 8), while demand projections during the same period could also reach 115,647 MW if the economy should expand at 7% (NREEEP 2015).

One of the key challenge for the restructured power sector is that distribution companies who have inherited tenuous networks and metering systems are already prioritizing the best paying customers with a negative impact on rural energy supply. Improvements in metering, energy efficiency, and common ground on tariffs are vital to maintaining and improving rural supply.

The Federal Government, NERC, and civil society organizations will need to engage more actively with privatized distribution companies to bring about viable solutions in this area.

2.1.2 Existing Plans/strategies

The Nigerian power sector, though privatised, still faces significant challenges both in terms of grid infrastructure development and availability of adequate private sector investment. In an attempt to address some of the challenges (e.g. liquidity), the Central Bank of Nigeria (CBN) and key players in the power sector including gas suppliers, electricity distribution and generation companies, among others, on 18th November 2014 signed a N 213 billion definitive agreement to begin the implementation of the CBN-Nigeria Electricity Market Stabilisation Facility (NEMSF). The facility is aimed at resetting the economies of the power sector and address liquidity challenges occasioned by legacy debts and revenue

[14] Cervigni et al (2013)

the power sector and address liquidity challenges occasioned by legacy debts and revenue shortfall in the sector thus guaranteeing the take-off of the Transitional Electricity Market (TEM). While the process of disbursement of funds and monitoring of implementation agreement is being worked upon, NERC is expected to reset the Multi Year Tariff Order (MYTO) to ensure it provide for the loan repayment including the costs of setting up and operating the NEMSF. The intervention fund is however expected to be repaid over a period of 10 years at a 10 per cent interest rate per annum; it will be used to settle the N 36.9 billion legacy debt owed gas suppliers by the defunct Power Holding Company of Nigeria (PHCN) and cover shortfalls in the Nigerian electricity market. These shortfalls are majorly occasioned by technical losses recorded in the sector.

2.1.2.1 Grid Infrastructure

A recent study of the Nigerian energy sector (GIZ 2015) observed that the national grid is characterized by poor voltage profile of network and constrained by limited control infrastructure. Overloaded transmission lines and high technical and non-technical losses are a regular feature. Transmission capacity is less than 6,000 MW with Low Infrastructure Coverage <40% of the country and low per capita of generation < 25 W.

Furthermore the grid infrastructure is to be upgraded to accommodate the inclusion of electricity from nuclear power plants.

15 http://www.cenbank.org/FeaturedArticles/2014/articles/CBNothersSignMoUonNEMSF.asp

16 http://www.cenbank.org/FeaturedArticles/2014/articles/CBNothersSignMoUonNEMSF.asp

Table 12 : Grid Capacity

Existing	On-going Projects	Expansion Plans
5,523.8km of 330 kV of Transmission lines • 6,801.49km of 132kV of Transmission lines • 32No. 330/132kV Substations with total installed transformation capacity of 7,688 MVA (equivalent to 6,534.8 MW) • 105 No.132/33/11kV Substations with total installed transformation Capacity of 9,130MVA (equivalent to 7,760.5MW) • The Average Available Capacity on 330/132kV is	• 986.5KM of 330kV Lines are under construction; • 705.3kM of 132KV Lines are under construction; • 1,350MVA Capacity of 330/132kV transformers are presently being installed in new substations; • 3,000MVA Capacity of 132/33KV transformers are presently being installed in new substations; • Overloaded Transmission stations are constantly being reinforced with additional capacity	All power stations to have alternative evacuation routes All State capitals to have 330/132kV TS All Local Govt. Headquarters to have 132/33kV TS All major towns, local Govt. Headquarters and State Capitals to be on dual source of supply All Transmission Stations to have at least 2 transformers that are less than 75% loaded at any time All Transmission Stations to be rehabilitated for automation operation

The Government retained control of the transmission and system operation under TSP. The transmission lines and generators are interconnected in a common grid, with a single control centre at Oshogbo. The Government bears the cost of grid expansion and encourages private investors to focus on generating capacity. Distribution companies have been privatised. They are since responsible for the expansion of the distribution network's MV and LV grid.

The National Grid operates at 330 kV and 132 kV Voltage level while the distribution grid operates mainly on 33 kV and 11 kV level (MV and LV). At the last estimate (2014) more than 12,300 km of transmission lines connecting 32 No.s of 330 kV and 105 No.s of 132 KV substations are operational while more than 24,000 km of distribution network is available.

At the current (2014) configuration the National grid has an installed capacity of 6,500 MW but can handle a wheeling capacity of maximum of 5,500 MW. The on-going NIPP projects will further boost the capacity by 1,300 MW. The long-term planning of TSP is to further improve the grid capacity to 10 GW by 2017 and 16 GW by 2020 as further detailed in the figures 7 to 9.

Figure 14: Existing 330kV Radial Grid, 2013[17]

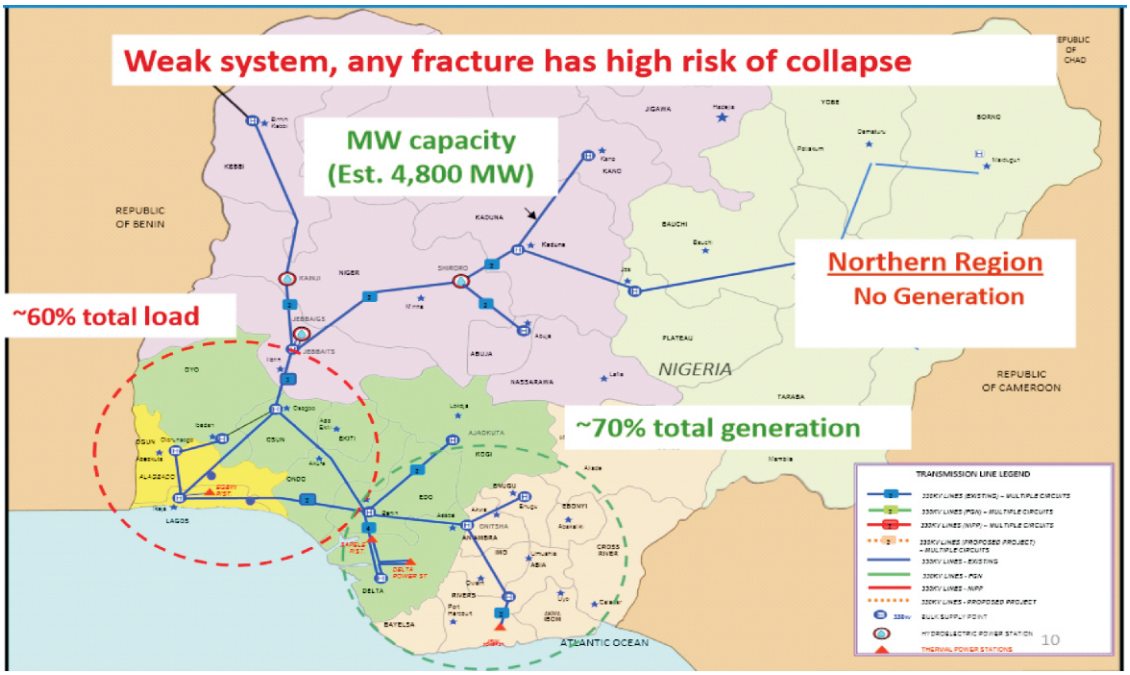
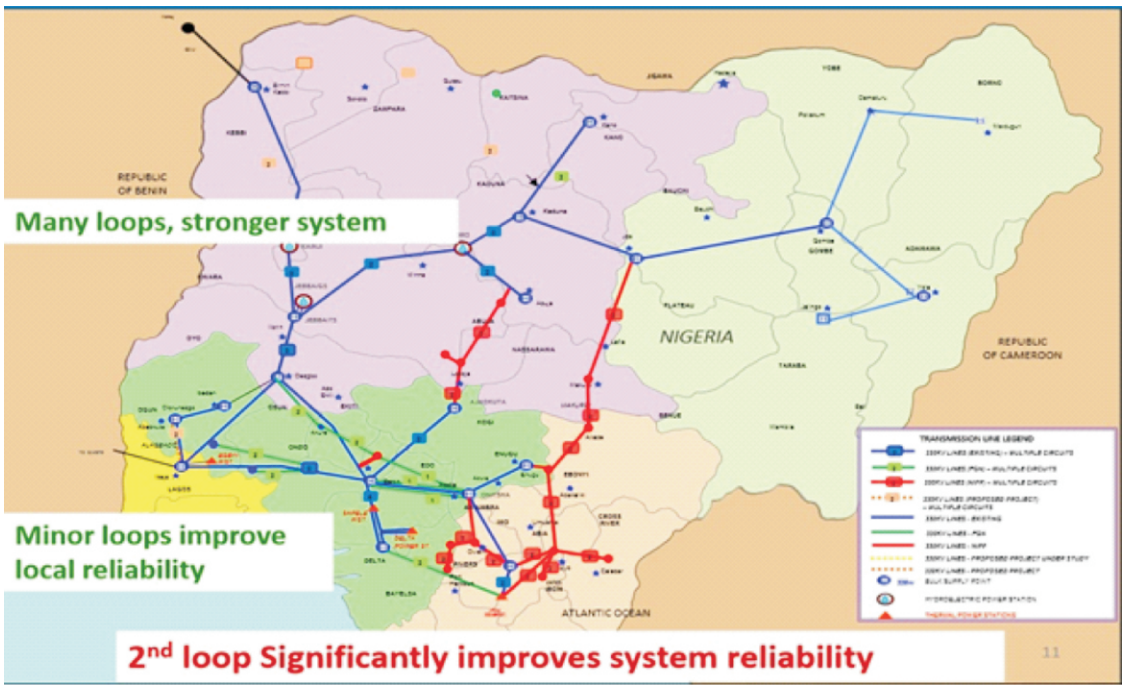
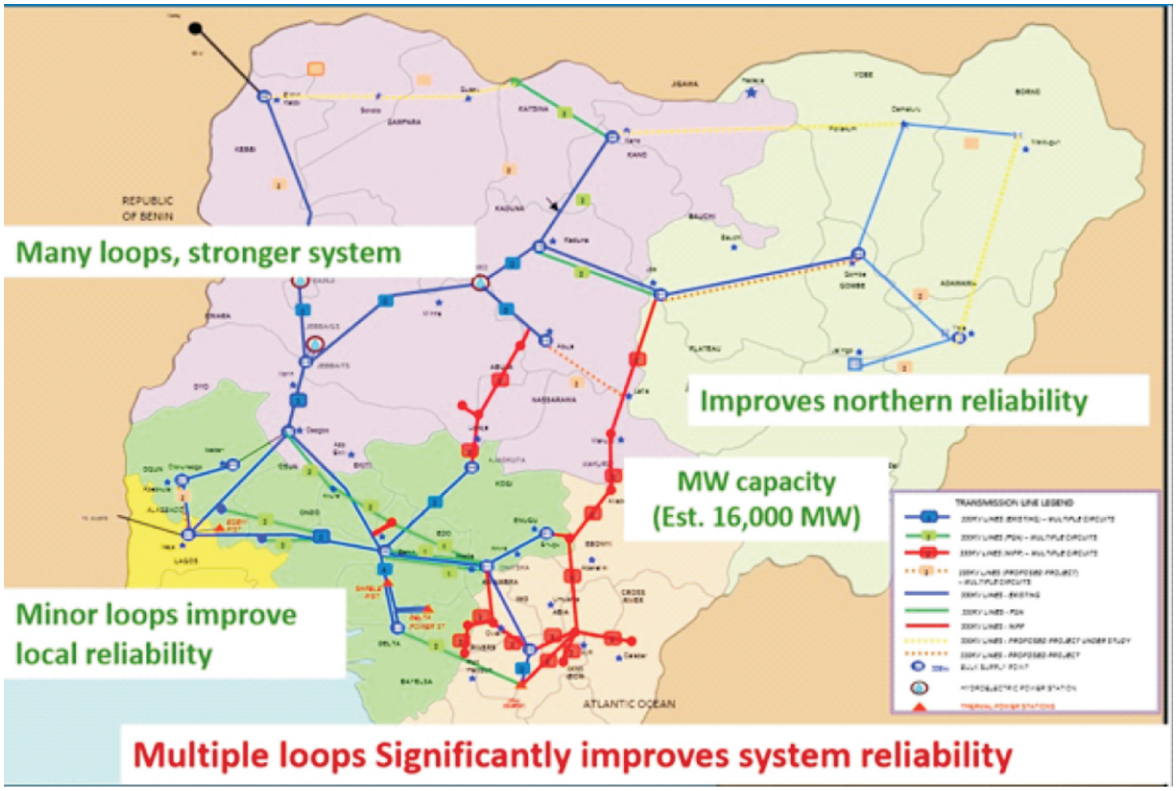


Figure 15: 330 kV Transmission Grid for Wheeling 10,000 MW, End 2017



[17] Source: TSP (2013). Figure 7 and 8 are also obtained from same Source

Figure 16: 330 kV Transmission Grid for Wheeling 16,000 MW, End of 2020



2.1.2.2 Distribution

Electricity Distribution in Nigeria is carried out by Eleven (11) companies (Table 20), however the distribution network across the country has underperformed over the years. This is due to faulty, heavily overloaded distribution transformers and vandalized lines resulting into limited supply to customers; overloaded 33 kV and 11 kV lines, distribution transformers, feeder pillars and LT lines resulting into power supply rationing during peak load periods; and aged or obsolete equipment whose performances can no longer be guaranteed. Some of the equipment has been phased out by their manufacturers, thus making spares unavailable.

Table 13: Eleven Electricity Distribution Companies

S/No	Electricity Distribution Company	Area covered (State)
1.	Abuja	FCT, Niger, Kogi, Nassarawa
2.	Benin	Edo, Delta, Ondo
3.	Eko	Lagos Island
4.	Enugu	Enugu, Imo, Anambra, Abia, Ebonyi
5.	Ibadan	Oyo, Ogun, Osun, Ekiti, Kwara
6.	Ikeja	Lagos Mainland
7.	Jos	Plateau, Benue, Bauchi, Gombe
8.	Kaduna	Kaduna, Kebbi , Sokoto, Zamfara
9.	Kano	Kano, Jigawa, Katsina
10.	Port-Harcourt	Akwa Ibom, Cross River, Rivers, Bayelsa
11.	Yola	Adamawa, Borno, Taraba, Yobe

The power sector has been grossly underfunded especially the distribution network. The distribution network all over the country has not undergone any significant improvement over the last ten years. Presently, the distribution lines are weak, over 70% of the substations are overloaded with so many distribution substation transformers burnt and needing replacement. Distribution infrastructure is now inadequate; operation and maintenance have become a problem exacerbated by ageing equipment in the system. A high percentage of the network, especially those inherited from Rural Electrification Agencies need restructuring and reinforcement. In order for Distribution Companies to develop a healthy network capacity needed to meet the maximum coincident demand or peak load of all customers, there is an urgent need to attend to the following:

- Improvement, rehabilitation, upgrade and expansion of the existing transmission lines to increase the overall capacity of the national grid for adequate and appropriately utilization, also to accommodate planned increase in demand at distribution levels.
- More distribution transformers need to be installed in upgrading, relief and extension of services. For example, Abuja Electricity Distribution Company urgently requires the injection of 210 distribution transformers of various sizes to cope with customer demands in federal capital territory.
- All long, aged and overloaded 33 kV and 11 kV feeders need to be relieved by creating new ones. This will improve system efficiency and reduce thermal losses in the system.
- Replacement of distribution transformers lost in circuit as a result of prolonged over loading will improve the customer satisfaction level.
- Reduction of overall system loss and improvement of performance efficiency and ensure proffer system planning at all levels.
- Need to introduce more technology into the network management to forestall network / equipment vandalism.
- There is a need for massive injection of energy meters into the system for appropriate metering of customer premises.

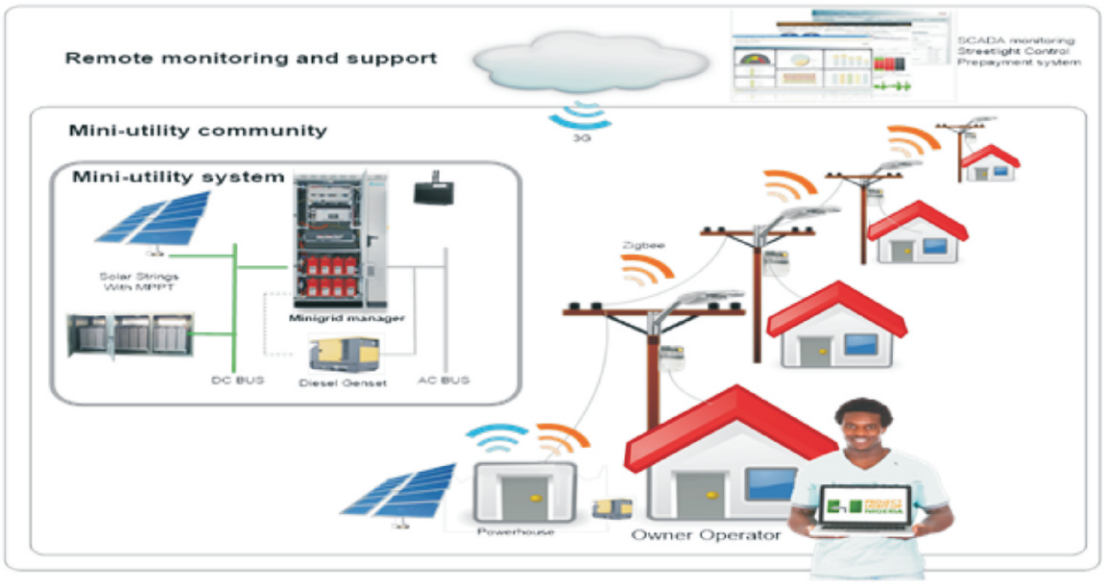
2.1.2 Rural Electrification Plan

Plans to provide necessary infrastructure and electricity to rural areas can be traced back to the 1980s with the introduction of the Nigerian Rural Electrification Programme. The aim of initiating this programme by the Federal Government was to expand electricity access rapidly in rural areas, and to ensure that energy services are available and affordable in a cost effective manner. However, this goal is still far from being reached. Current (2015) estimate shows that only about 26% of rural households have access to electricity. Growth in demand for electricity in the rural areas of Nigeria has outpaced supply and population growth has driven the rate of new household formation higher than the rate of new

connections. As a result, rural households still rely on fuel-wood and other expensive, unhealthy and unsustainable sources of energy.[19]

Reaffirming its commitment to reaching the proposed 75% electricity access by 2020, and 100% by 2040, the Federal Government of Nigeria in the draft RESIP 2015 estimated that a service extension to additional 471,000 rural households each year will be required from 2015 to 2020; and an annual additional 513,000 rural household connections from 2020 to 2040. The cost of reaching these targets is estimated between NGN 317.8 billion and NGN 525.8 billion [a minimum of NGN 50billion per annum]. These figures include administration and project costs respectively. It is therefore clear that the required funding and investment will come from a combination of sources including the FGN, other Nigerian Government entities (e.g., State and Local Governments, relevant Ministries), electricity companies and customers, international donors and development banks, commercial banks (both domestic and foreign), RE scheme operators and customers (i.e., end- users), and equity investors. In taking the drive forward, the Federal Ministry of Power on behalf of the Governmenthas re-designed the Operation Light-Up Rural Nigeria initiative from the conventional Micro-grid with no payment system to an off-grid Micro Utility with the full functionality of pre-payment and power management systems integrated to collect revenue from the project and manage load demand, thus creating the Renewable Energy Micro-Utility (REMU) Concept (Figure 10).

Figure 17 : Renewable Energy Micro-Utility (REMU)



REMU is designed to be a Sustainable Platform for Integrated Economic Empowerment (SPIE) through the development of renewable energy resources in Nigeria in an economically attractive manner. The goal is to generate, distribute and trade electricity in

[18]Draft Rural Electricity Strategy and Implementation Plan 2015
[19]Draft Rural Electricity Strategy and Implementation Plan 2015
[20]Draft Rural Electricity Strategy and Implementation Plan 2015

off-grid villages using locally available renewable energy resource thus offering rural off-grid villages' sustainable, affordable, reliable and convenient electricity at the same time creating a viable business for the investors. The off-grid Renewable Energy Micro-Utilities would have capacities ranging from 10 kW – 1000 kW with different electricity tariff structures; prepaid power purchase and transactions; automatic power protection and control; and Internet based data management system. The system will allow rural customers to pay only for the power they use and enjoy an all year round reliable supply.

The Ministry of Power is currently working with a number of OEMs, Solution Providers, Project Developers, Financiers and Development Partners to promote the Renewable Energy Mini-Utility (REMU) Concept. Golden Grid Solution Inc, USA has worked closely with the Ministry to promote the REMU initiative and has developed detailed description of the technical and commercial structure to ensure the economic sustainability of the new Renewable Energy Micro-Utilities. Considering that these are Proprietary Systems, the Ministry of Power have a strategic framework in place that will be used to work with the OEM/Solution providers and Bureau for Public Procurement (BPP) to ensure a smooth procurement of project under the Light up Nigeria programme, also all equipment supplies are guaranteed to have full connection interface access to the REMU software management and vending system via an open sources communication protocols.

It is estimated that each project under the REMU initiative will cost between USD ($) 3.5 million and USD ($) 6 million, for a fully integrated functional REMU of capacity range of 500 kW – 1000 kW, funding options currently explore include Green Bonds and other forms of private partnership financing.

2.1.3.1 Existing Gaps-Energy Access

2.1.3.2 Access- Electricity

The Rapid Assessment and Gap Analysis (2012) observed that there is currently no policy in place in the country that distinguishes between urban and rural households' energy needs. Energy needs from both groups vary and government need to collaborate with financial institutions and local energy suppliers to develop appropriate and effective framework access to energy for households and explore sources of energy other than electricity and wood. Similarly, rural electrification and energy access programmes in Nigeria are still largely funded by the public sector hence budgetary allocations for rural electrification are not evenly distributed across rural communities. Other specific gaps are highlighted below-

Table 14 : Access-Electricity Access

Aspects	Gaps	
Financial	(i)	Lack of access to funding for energy a ccess investments
	(ii)	Many financial institutions in Nigeria do not have a dedicated financing window for energy access.
	(iii)	High levels of taxation, low support for foreign direct investment, high interest rates, and uncertainty around
	(iv)	government fiscal policies. Inadequate provision of long - term stability in investment climate for energy access
	(v)	infrastructure projects.
	(vi)	Limited government financial incentives such as subsidies, grants for energy access projects.
		Low carbon energy access initiatives are still class ified as high risk investments as the availability of such
		technologies is very limited. For example, solar, wind, and biomass energy plants in the country are yet to be
		connected to the grid. Existing ones are at planning or construction stage. Similarly, small -scale off grid
	(vii)	decentralised power plants are not given much priority in the national strategy for power expansion
		The high upfront cost of modern energy access infrastructure is a major problem. The rural poor in most cases
	(viii)	cannot afford to pay for the initial capital cost to access a decentralised form of energy.
		Huge gap between modern access in the rural and urban areas of the country due to the fact that the majority
	(ix)	of rural population is energy poor, as over 75% of their household energy consumption is dominated by cooking
		needs met by traditional cooking stoves.
		Weak purchasing power due to the rate of poverty also affects the ability of customers to switch from traditional
		energy sources to modern (energy access) technology.
Institutional and Regulatory	(i)	Lack of appropriate financial mechanisms tailored to meet the social and political aspects of energy access.
	(ii)	Lack of right institutional framework that creates an enabling environment for modern en ergy access
	(iii)	technologies.
		Complex practice of expanding access to modern energy services in the country due to the dual nature of the
	(iv)	energy system across the country where traditional and modern energy systems practices co-exist.
	(v)	Lack of long -term nation al strategies and large -scale programmes with substantial financial resources.
		Until recently, public institutions tended to dominate the drive for energy access services in the country; the
	(vi)	involvement of the private sector is yet to be visible.
		Althou gh targets for energy access are in place, there are limited policy instruments/mechanisms approved by
	(vii)	the Government that will spur private sector investment. Very limited private sector actors have been attracted
		so far into the energy access market of t he country.
	(viii)	Lack of continuity in government policies: there is usually huge uncertainty regarding the policy direction of the
		government that will succeed the present.
		Lack of clear regulatory framework that is specific to energy access services and its implementation.
Technical	(i)	Poor state and low capacity of electricity infrastructure in the country leading to high transmission,
	(ii)	generation, and distribution costs. Lack of high level technical skills for modern energy access
	(iii)	technologi es.
	(iv)	Modern energy access services are relatively new in Nigeria so there is a general perception of a lack of
		trust in untested technologies. There is also an inadequate number of professionals.
Capacity Building and Availability of Information	(i)	Research and Development capacity is very limited in the country as Nigerian R&D institutions fall short in
		many respects, e.g. funding, infrastructure, and enabling environment
	(ii)	Lack of awareness of the potentials and benefits of energy a ccess services serves as a major constraint to the
	(iii)	development of the sector. Lack of time, appropriate and truthful information on energy access services
		bringing about underlying project risks that tend to be overrated and increasing transaction costs.
	(iv)	Low level of awareness among private sectors in renewable energy and other related energy projects that
		could promote a low carbon economy.

2.2 Nuclear Energy

2.2.1 Current Status and Trajectory

In recognition of the need to improve the national electricity supply in the country, and explore the potential of nuclear energy, the Federal Government of Nigeria (FGN) established Atomic Energy Commission (NAEC) as the focal promotional institution to provide the technical leadership to achieve this national objective. NAEC developed a technical framework which would serve as the road map for achieving the set goals for nuclear energy in Nigeria. Furthermore, an initial Strategic Plan for the Implementation of the National Nuclear Power Programme in Nigeria was approved in December, 2009. Since then, a number of refinements have been made to the implementation strategy, taking into consideration many technical factors including technology, financing, ownership and contractual issues, with a more realistic timeline that will result in commercial operation of the first nuclear power plant (NPP) with the injection of at least 1,200 MWe to the national grid by 2025, and increasing the capacity to up to four NPPs of 4,800 MW by 2035. Subsequently, over the past five years, various aspects of the 2009 National Strategic Plan have been implemented. In the process, Nigeria has also completed a self-assessment exercise on the development of its critical nuclear power infrastructure. This assessment was aimed at determining the achievements, possible gaps and future needed activities of the national effort for the successful completion of the nuclear power programme. The implementation of the national nuclear programme is a multi-faceted process, taking into consideration many factors, with the concomitant difficulties in achieving expected goals/targets within schedule resulting in possible project delays. Furthermore, the revisions in National Energy Policy in 2013, and the lessons learned from the national self-assessment exercise, occasioned the need to revisit the 2009 National Strategic Plan and make appropriate revisions to achieve set objectives.

Consequently, the revised edition of the Strategic Plan for the Implementation of the approved National Nuclear Power Programme, has taken into consideration the achievements made so far, the current state of activities, identified gaps and the dynamics of the requisite timeline for the successful completion of the Programme. The revision was effected with the active participation of all relevant stakeholders. The revision envisages that the first NPP will commence commercial operation by 2025 with additional three units added to the grid by 2035. This timeline has resulted in the extension of the first full cycle of the nuclear power programme implementation to cover the period 2006-2035.

[21] The technical framework consist of a three-phase programme, with a plan of action and attendant timelines, subsequently approved and adopted by Government

2.2.2 Existing Plans/Strategies

The Nuclear Energy Policy states that:

- The nation shall promote the development of nuclear energy, and undertake all activities related to the peaceful uses of nuclear energy in its entire ramifications.
- The nation shall pay adequate attention to safety, security and safeguards issues in the pursuit of and operation of its nuclear programmes.
- The nation shall strengthen all institutional and legal/legislative frameworks and ensure their operations.
- The nation shall encourage and fund the development of the requisite manpower and provide the enabling environment for the acquisition of competencies and skills needed for the design, construction and operation of the nation's nuclear facilities.
- The nation shall support research and infrastructure development necessary to enable rapid domestication, and encourage intellectual property rights.
- The nation shall cooperate with the International Atomic Energy Commission and other international organizations involved in the peaceful use of nuclear energy.
- The nation shall ensure the storage and disposal of nuclear waste is done in an environmentally friendly and sustainable manner.

2.2.2.1 National Nuclear Power Programme Strategic Plan, 2015 (SP-15)

The goal of the SP-15 is aimed at setting out the mechanisms, ways and means of creating the enabling environment for a sustainable implementation of the approved national nuclear power programme as laid out in the technical framework, leading to the generation of at least 1000 MWe from Nigeria's first NPP by 2025 and increasing the capacity up to 4800 MWe by 2035 from additional NPPs.

Figure 18 : Strategic Plan for the Implementation of the National Nuclear Power Programme 2015

22 Please see Nigerian Nuclear Energy Policy for short-long term objectives and strategies

The objectives of this Strategic Plan, amongst others, include:

a) Addressing the significant critical enabling conditions (technical, regulatory, environmental, financial, legislative, organizational, political and public acceptance) that must be met to achieve the desired goal.

b) Planning for the nuclear fuel cycle, radioactive waste and spent fuel management.

c) Assigning responsibilities to the appropriate/relevant national stakeholder organizations for the achievement of the enabling conditions as mandated by their respective Acts.

d) Fostering effective coordination and synergizing of the inputs of all relevant stakeholder organizations/industries for the utilization of their respective expertise and resources to achieve the desired goal.

e) Ensuring effective and efficient human resource development and building of the requisite capacity for the sustainable operation and maintenance of all NPPs.

These objectives are in line with the provision of the IAEA Milestone approach (Nuclear Energy Series, NG-G-3.1).

2.2.2.2 National Support for Nuclear Energy (Existing and Planned)

Financing Mechanisms - The financing of a nuclear power project is unique because it is capital intensive, involving a long construction period with attendant possible cost overruns in the event of construction delays, and issues of public concerns. As part of its fiscal responsibility in establishing a nuclear power programme, the Federal Government of Nigeria has taken on the responsibility for funding the development of the pertinent nuclear power infrastructure through annual budgetary allocations. The key elements covered by this include the training of the critical manpower base and building of the critical national nuclear infrastructure for the successful introduction of nuclear power.

For financing, the FGN has approved a Build Own Operate and Transfer (BOOT) contractual model for the financing of the Nuclear Power Plant project in the country. In line with the FGN approval, the project will be implemented through international partnerships and execution of the requisite Inter- Governmental Agreements. The processes are on-going to conclude the real aspects of negotiating a contractual agreement with the vendor country.

2.2.2.3Existing Gaps

Table 15: Existing Gaps-Nuclear Energy

Aspects	Barriers, Challenges and Risks
Financial	i. Capital intensive ii. Long construction period iii. Uncertainties regarding costs and schedules iv. Initial capital outlay for nuclear is more expensive than for other energy sources but reliability and full life cycle costs are lower v. Lack of incentives for companies involved in developing nuclear infrastructure vi. Non finalization of agreements, detailed financing structure and assignation of responsibility for ownership and operation of NPP
Institutional and Regulatory	i. Prolonged periods encountered for passage of legislation for revisio ns and refinements of enabling legislations ii. Conflicts and duplications in mandates of public sector actors due to a lack of synergy in coordination may sometimes result drawbacks iii. Dominance of public sector institutions and a lack of private sector involvem ent iv. In the past, lack of continuity in government policies leading to programme/project delays
Technical	i. The present national electricity grid capacity is inadequate and will need expansion and upgrade in collaboration with NPP vendor to receive the input of electricity from nuclear power. There is need to undertake detailed grid studies ii. Insufficient capacity of the local industries to participate in the NNEP iii. Management of nuclear fuel, radioactive waste and spent fuel iv. Detailed environmental impact assessm ent (EIA) of NPP preferred sites and MoU on the roles and responsibilities of FMEnv and NNRA on the EIA process awaiting completion
Capacity Building and Availability o f Information	i. The number and level of expertise is inadequate to sustain the nuclear po wer programme, however, they form the initial core of professionals for programme ii. Inadequate nuclear science and nuclear engineering curricula in the u polytechnics iii. Fear of nuclear technology due to lack of awareness iv. National Public Information and Communi cation Strategy for nuclear power programme not finalized

2.3 Usages of LPG in Nigeria

2.3.1 Liquefied Petroleum Gas (LPG) - Current status and trajectory

The Nigerian LPG market has had a turbulent ride. It went from a high of 200,000 MTPA following the FGN Butanization programme in the 1990s to a low of 50,000 MTPA in the early 2000's following the well-publicized decline of the nation's refineries, then the primary source of LPG. This forced a further series of well-meaning but unfortunately largely uncoordinated FGN programmes in terms of fiscal and policy support. Listed below are a few of the FGN interventions to date:

1. The Butanization programme in the 1990s aimed at ensuring domestic gas availability and efficient supply and distribution network around the country.
2. Deregulation of the market, which unfortunately was then impeded by unfavorable fiscal policies e.g. change of taxation on LPG equipment and introduction of VAT on domestically produced LPG (thus favoring imports).
3. The establishment of the now defunct “Presidential LPG Steering Committee” in 2003 under the office of the Special Assistant to the President on Petroleum Matters, Alhaji Ja'faru Paki, who became the defacto “LPG Champion” for Nigeria.
4. In 2004, a World Bank study resulted in the setting up of a committee to develop a road map and strategy to harness the content of the World Bank report. This initiative has stalled along with many others.
5. The FGN mandate to ExxonMobil in 2006 to make available NNPC's share of production from the NNPC/Exxon Mobil Joint venture totaling 350,000MT. This initiative again stalled due to inadequate LPG infrastructure in the country from terminals down to cylinders.
6. An increase between 2008 and 2010 in tariffs and taxes applicable to LPG equipment making these more expensive locally.
7. In 2007, the Federal Government intervened by mandating Nigeria LNG Limited to divert 150,000 MTPA of LPG to the domestic market. This has achieved moderate success with the domestic market now hitting about 250,000 MTPA in the year 2014 (source: NLPGA). success with the domestic market now hitting about 250,000 MTPA in the year 2014 (source: NLPGA).

Despite the laudable interventions by the FGN, the transformation towards making LPG the primary cooking fuel for Nigerians has not been significantly achieved cf. a target of a national consumption of 1.5 million MTPA by 2015 as set out in the 2003 World Bank report. It is instructive though to note that the two most successful aspects of previous interventions by the FGN were items 3 and 7 above, which may be summarized thus:

- the appointment of a dedicated LPG Champion with access to the highest levels of government and with the clout to overcome inter MDA bickering and friction, as well as drive policy direction over a prolonged period; and
- a recognition of the crucial role that the private sector brings in driving increased supply and reduced pricing, which necessarily needs to be supported by appropriate fiscal and policy incentives (at Federal and State levels).

With her enormous natural gas reserves estimated at about 180 trillion cubic feet, Nigeria is rated the largest producer of cooking gas in Sub-Saharan Africa, largely from the NLNG and the refineries.

The Nigeria LPG Industry has been growing slowly over the years due to supply constraints and other factors in the value chain. (*The consumption growth rate between 2005 and 2014 was 39%)*. The present Nigerian population of 190 million people should be consuming about 5 million Metric Tons (MT) if LPG was the major fuel for cooking. The reality today is that Nigeria consumes an average of 275,000 MT per annum. Firewood and kerosene usage are still major competitors to LPG, especially in the rural areas. This is a huge gap from the expected consumption annually. In Lagos alone, there is a potential market for 1,000,000 tonnes annually.

LPG, as has been proven elsewhere in the World, can be utilized positively to stimulate Health, Manufacturing, Environmental, Economic and Agricultural benefits within a nation's economy. Global production of LPG is far outstripping demand, which presents an opportunity to utilize what is becoming a low cost fuel. Unfortunately the reality for LPG in Nigeria in 2016 remains one of "*Famine in the Midst of Plenty*" due to various challenges.

Some of the factors affecting Liquefied Petroleum Gas (LPG) growth in Nigeria over the years are listed below:

- Massive inadequate supply of LPG equipment (cylinders, hoses, regulators, stoves etc.) for the end users.
- High "first costs" associated with acquisition of cylinders and LPG stoves by consumers. The average start up pack (cylinder, stoves, hoses & regulators) to a potential user is 83% higher than starting with kerosene stove for cooking.

- Insufficient number of jetties and few LPG inland storage facilities across Nigeria

- Increase in price of LPG due to logistic issues

- The major competing products affecting LPG growth in Nigeria are kerosene, firewood and charcoal. Preference is often given to kerosene over LPG, which is cleaner, more efficient and also cheaper. The Nigerian government could implement the Indonesian project on LPG.

- Excessive import duties and VAT on LP Gas equipment

- Firewood and charcoal still make up 62% of the energy mix in Nigeria, which hinders the growth of LPG in Nigeria and also significantly contributes to air pollution

- Inadequate road and transport network facilities

- Access to long-term funds for LPG project is cumbersome.

- Fabrication of LPG equipment is very expensive due to lack of stable power and high cost of raw material, labor and generating power for production.

- There is no major policy that encourages widely promoted green projects (e.g. auto gas, power generation etc.) using LPG in order to stimulate the rapid growth of the industry.

LPG is a clean, potable, efficient, convenient and safe alternative fuel in many applications. LPG has relatively low emissions when compared to other cooking fuels like firewood and kerosene, and, according to the World Liquefied Petroleum Gas Association (WLPGA), LPG delivers far higher calorific value/heat content per unit compared to firewood or kerosene. Rather than use the safer, cleaner but more expensive LPG as domestic fuel, most Nigerians utilise firewood, coal and kerosene, resulting in indoor pollution, which accounts for over four million deaths globally every year (WHO 2010).

2.3.2 Existing plans / strategy for LPG

Case studies of countries like Indonesia give an indication of how aggressive LPG usage programs (commercial and otherwise) could solve subsidy issues by reducing large expenditure on kerosene.

To overcome affordability issues, Indonesia, for example, initiated a cylinder program in 2007 and has, since then, introduced over 56 million units of 3kg cylinders in the country free of charge. It targeted household consumers and small and medium-scale businesses and withdrew 3.26 Billion litres of kerosene.

In some West African countries like Ghana and Senegal, consumption of LPG has increased over the years. Ghana with a population of 25 million grew her consumption from 78,000

These market growth confirms the rate at which the developing countries are migrating from kerosene to LPG in order to reduce carbon emissions and create a healthy living environment for their citizens, and substantial tax revenues for governments through employment generation in the LPG sector.

LPG is acknowledged to be an underutilized fuel. However, the drive for the use of LPG in the Nigerian economy is not simply predicated on the that use of LPG for consumption sake but more driven by how it can be translated into jobs for the millions of unemployed Nigerians and used as a means to alleviate poverty. Many value addition opportunities exist for LPG in the economy, such as:

- Domestic Applications:

Local manufacturing of LPG cylinders and accessories (valves, regulators etc.), a recent initiative of the Nigerian Content Development and Monitoring Board (NCDMB a.k.a. Local Content). Nigeria presently has a population size of less than 3 million against a potential cylinder population of 50 – 100 million when judged against countries of similar size (Brazil and Indonesia). These additional cylinders should be manufactured locally to stimulate employment. Yet, the main cylinder manufacturing companies in Nigeria remain moribund due to excessive Government taxes on raw materials and huge energy generation costs.

- Power:

o The use of LPG in power generation would allow cheaper off grid power to be deployed to Nigeria's hinterland, reducing the burden on the already over stretched national grid. Increased productivity and services would be encouraged as a result of cheaper energy.

- Autogas:

o Manufacturing of conversion kits for use in Autogas applications, which are presently non-existent today. With unrecovered LPG in abundance in local flared gas, Autogas presents an opportunity for the automotive as well as manufacturing sectors of the economy.

- Industry:

o In Agriculture, several uses of LPG that would stimulate this sector include: pasteurization of dairy products; drying of grain and crop; meat, poultry and fish product sanitization; chick hatching etc.

o Off grid solar/clean energy cold rooms for vegetable preservation and meat produce conservation long the cold chain all the way from “farm-to-fork”.

2.3.2.1 Existing Gaps

Table 14: LPG Market Gap[23]

Aspects	Gaps
Policy and Regulation	To date there is very limited Government policy that supports the expansion of LPG industry in Nigeria. While Nigeria has become a major LP Gas exporter, nothing has been done to secure domestic supply from indigenous sources in the absence of refinery supply. Gas strategy planning and policies appears to be focused on natural gas while the policy of butanization has not been sustained. The LP Gas industry relationship with its regulatory body— DPR—has emphasis on the licensing of facilities and on statistics. There is little evidence of any ongoing constructive dialogue between the DPR and the LP Gas industry. The DPR also has adopted a standard-setting role but lacks a specific department, or division, for LP Gas affairs. The Standards Organization of Nigeria (SON), has a limited role that appears to be confined to checking the standards of cylinders and valves, as manufactured or imported, plus overseeing weights and measures checking.
Institutional Landscape and Capacity	The Nigeria LPG Association (NLPGA) is the umbrella body of all Stakeholders in the LPG sector in Nigeria include the NNPC, NLNG, Total Nigeria Plc, MRS Oil, Oando Marketing, National Association of Liquefied Petroleum Gas Marketers (NALPGAM), Federal Fire Service, Lagos State Ministry of Energy and Mineral Resources and the Lagos Chamber of Commerce and Industry (LCCI) amongst others. The primary objective of the Association is to promote the safe use of LP Gas in Nigeria at affordable cost. industry and the entire Nigerian socio-economic environment at opportunities etc. Finally, it represents the opinion of the stakeholders on all matters, which impact on the investment envi economy as a whole
Facilities	Over several years, poor refinery performance has starved the domestic market of LP Gas. The LP Gas price from the refineries has been aligned more to "import parity" than "export netback parity." Inadequate loading facilities and low priority have consistently impeded evacuation when LP Gas was available. The domestic LP Gas market depends effectively on the refineries, and they have proved to be unreliable suppliers. Greater diversity of indigenous supply is required since importation is not commercially viable, nor should it be necessary. Part of the efforts made by stakeholders in the LPG industry have included heavy investments in LPG terminals to aid the free flow of the product.
Cylinder	Most of the existing cylinders are in poor condition, because of age and lack of proper maintenance. Significant inputs will be required to supply new consumers and to bring the cylinders of existing consumers to a reasonable standard. Household surveys have indicated a suppressed demand for LP Gas nationwide and across different socioeconomic groups. Without subsidy or soft financing, the initial cost of becoming an LP Gas consumer will be a formidable barrier to access for the poor. Outreach retail outlets and appropriate sized cylinders for the poor in rural areas are lacking. The survey indicated a perception that moving to LP Gas from traditional fuels may be dangerous. A major problem militating against the domestic supply of LPG in Nigeria is the challenge of logistics due to absence of reception facilities and jetties for both imported and NLNG's LPG vessels. The NLPGA is partnering with the Standards Organization of Nigeria (SON) on enforcement to eradicate substandard LPG cylinders and quality of the LPG product.
Public Awareness	While many consumers express satisfaction with LP Gas, there is a perception that it is unsafe. No statistical record of accidents was found but the incidence may be significant, given the condition of cylinders and prevailing practices. Despite positive consumer attitudes toward the product, the LP Gas industry has a poor public image. Media coverage tends to highlight the industry's problems. The household survey reports disclosed specific accident experience and safety concern.

2.3.3 Other Clean Cookstoves:

The Federal Ministry of Environment Renewable Energy Programme through its programme the National Clean Cooking Scheme (NCCS) launched in September 2012 is currently working in partnership with pot-makers Tower and energy firm Envirofit through its Rural Women Energy Security (RUWES) programme for the production and distribution nationwide of a purpose designed bio-mass stove. To further strengthen the scheme, in 2014, the federal Government approved the sum of NGN 9billion for the distribution of 750, 000 Clean Cook Stoves and 18,000 Wonder bags to Nigerians, in a bid to stop the depletion of forest resources caused by indiscriminate felling of trees. In five years, the NCCS aims to distribute at least four million clean cook stoves in each of the six geo-political zones and provide 20 million clean cook stoves through- out the country. The scheme also seeks to reduce the persistent felling of trees which exposes the country to ecological problems including desertification. Similarly, in December 2014, the National Assembly Intervention on Clean Cooking Initiative (NAICCI) was also launched to National Assembly members to foster the adoption of clean cook stoves in their constituencies so as to positively impact on the health of women who have to contend with respiratory infections and ailments due to indoor air pollution and smoke inhalation. Furthermore, the Global Alliance for Clean Cookstoves (Nigerian) and governmental stakeholders and partners are working to enable 17.5 million households to adopt clean cookstoves and fuels by 2020. The Alliance enterprise development fund has also been created to provide Nigerian enterprises access to investment and financing opportunities thus, strengthening the production and distribution of clean cook stoves in the country. The Alliance's efforts have helped to develop a National Testing Center as a facility to test cookstoves and fuels, while supporting a Nigerian Alliance for the sector, and the capacity of stakeholders in the value chain including SMEs, financial institutions, microcredit institutions, NGOs, CBOs and Faith-Based Organizations to advance the country's clean cookstoves and fuels sectors. Finally, the Nigerian Alliance for Clean Cookstoves in partnership with the Alliance is working to bring in 100 new partners, including from the private sector, by the end of 2015 to further strengthen and support the distribution and marketing needs of the Nigerian clean cookstoves and Fuels market.

2.3.3.1 Access- Other Clean Cooking

- While current efforts such as NCCS, NAICCI, and other joint effort with Global Alliance are on-going, there is no defined target to reach households by 2020 and beyond. In addition there is yet to be a policy developed and adopted at National level integrating NCCS into national interventions to achieve SE4ALL 2030 goals of improved cook stove.

[24] http://renewableenergy.gov.ng/national-clean-cooking-scheme-flags-off-in-kaduna/

[25] http://www.premiumtimesng.com/news/more-news/171913-nigeria-distribute-million-clean-cook-stoves-free- citizens.html

- Current UNDP rating rank Nigeria 10th in the world in terms of indoor pollution. This ranking is due to the fact that most rural households still use solid cooking fuel (firewood) for their cooking. Awareness and education about new and improved cookstove is still much done around urban areas order than rural areas. If Nigeria will achieve its 2030 goal there is need for aggressive campaigns and public enlightenment for the application of improved cook stoves.
- There is currently very limited data on the demand and supply of improved cookstove in Nigeria. Database to showcase roadmap for reaching wide range of rural and urban population is lacking and most especially it is not know yet what the ability to pay scenario looks at the moment especially in rural communities where the cost of wood fuel is close to zero as compare to improved methods associated with costs. The willingness to trade-off current cooking method with a modern one is yet to be determined. When this is determined, demand and supply analysis can then be carried out.
- The quality and production of improved cook stove in the country is still very low. Very recently through the joint effort of the Global Alliance for Clean Cook Stoves (GACC), a test centre was established in Ebonyi State-Nigeria. This facility though a welcome initiative is grossly insufficient to serve the Nigeria population and cook stove industry thus it can be concluded that to date clean cooking and modern improved solutions standard and efficiency testing facilities is inadequate and unaffordable by many local investors.
- Lessons from current experience regarding the deployment and application if improved cook stoves in the country shows clearly that there is no sufficient professionals with the right skills both in terms of manufacturing, distribution, and advisory services.
- Due to government subsidy, the use of LPG is very low compared to Kerosene and other cooking fuels. Nigeria is among one of the ten countries in the world with huge gas reserve however, no plan/strategy exist on how to translate this into making gas available at affordable price for cooking.

2.3.4 Actions Needed to Achieve the Overarching Objective of Energy Access

- **National Energy Plan**- the Federal Executive Council to make the document achieve its objective. A national energy plan will not only showcase government's effort and plans towards achieving SE4ALL and SDG 7 goals but also will highlight the energy services of the country and technologies required to explore/deploy these sources. The objective of this action is to have a comprehensive plan for managing energy for the whole nation and contains the entire history of energy for the nation and future energy plans. As such it is an important national document that covers every area that uses energy, purchases energy, financial options of the entire energy sector. It will include specific strategies designed with

[26] http://renewableenergy.gov.ng/national-clean-cooking-scheme-flags-off-in-kaduna/

[27] http://www.premiumtimesng.com/news/more-news/171913-nigeria-distribute-million-clean-cook-stoves-free- citizens.html

financial options of the entire energy sector. It will include specific strategies designed with civil society and educational institutions on how to improve broad public understanding of SE4ALL goals, their importance for sustainability, and vitally how communities and businesses can engage to improve their energy situation. It will include specific strategies designed with civil society and educational institutions on how to improve broad public understanding of SE4ALL goals, their importance for sustainability, and vitally how communities and businesses can engage to improve their energy situation. (Responsible Institutions: FMP, FMPR, FMF, FMWR, FMARD, FMLHUD, NNPC, ECN, NERC in conjunction with the private sector, international NGOs and civil society).

- Grid Infrastructure- To guarantee supply efficiency immediate action need to be taken with respect to- (i) Securing a multi-year investment budget for upgrade of the grid capacity (ii) rehabilitation, upgrade, and expansion of the national grid (ii) increasing current generation capacity across the country and ensure that current load factor is increased with measures to reduce both technical and commercial losses put on place (Responsible Institutions: FEC, FMF, TSP, FMP, NERC, GenCos, DisCos, and NEMSA).

- **Promotion of Efficient Electricity Generation Technologies in Urban and Rural Areas** With the current transition in the country's electricity sector there is need for the GenCos, DisCos, TSP, FMP, FMWR, REA, IPPs, NBET, NERC, and NEMSA to put in place measure geared towards improvement of efficiency of all electricity generation plants. The measures should be such that support all forms of electricity generation systems including co-generation or natural gas combined cycle technology. Actions required in this regard include the following-
  - Capacity building for stakeholders, mobilization of financing, demonstration of the benefits of all electricity generation systems including co-generation and mini-grid systems, promotion of more favourable policies and institutional arrangements;
  - Conduct feasibility studies and develop bankable business plans for potential sites across the country. The role of NERC as the regulator is required here to assit with setting and show
  - Developing and enhancing local capacity of project developers, technical service providers and local manufacturers of modern and efficient generation systems;
  - Mobilizing financing for mini-grid generation for electricity supply to rural areas remotely far from the grid and cogeneration projects;
  - Demonstrating the commercial, technical, economic and environmental benefits of modern, efficient cogeneration and mini-grid systems with a number of new plants across geopolitical zones of the country.
  - Promoting more favourable policies and institutional arrangements that support green mini-grids (GMG) and cogeneration systems.

- **Aggressive Rural Electrification and Access Plan-** Its suggested that this plan be designed by the REA in collaboration with SREBs, and in partnership with private sector stakeholders and civil society. The motive of this plan should be to bring energy solutions to rural communities that cannot be reached by the grid expansion between the short-medium term period (at least by 2025). A part of the plan should define the need, the willingness and the financial affordability of the rural communities targeted and driven by a technology that is commercially ready, affordable and adequate for the solution that is pursued. As well as making the plan adaptable, a wide range of business and financial models should be integrated into the plan so as to guide private partners to develop and invest in sustainable decentralized electricity projects in Nigeria.

- **Electricity for Rural Productive Uses program-** This program should target rural communities across the country and provide them with solar based solutions for lighting, refrigeration and water pumping. Linked to this is the need to develop a Green Mini-grid framework and adapt same to implement the REMU concept to promote mini-grids and stand- alone energy systems in remote areas, especially using primarily a commercially viable renewable energy sources available in each location. FMP, REA, and SREBs should work with the private sector, local stakeholders, donors, regional organizations, and civil society to actualise this concept.

- **Integrated Resource Plan-** the goal of the integrated resource plan will be to offer the country an opportunity to provide a plan for meeting forecasted annual peak and power demand of the country. Nigeria is currently ranked one of the emerging economies of the world thus, an integrated resource plan will help the nation to deliver reliable electricity services to end users through a combination of the supply side and demand side resource management over a specified future period. Common actions taken in developing an integrated resource plan include- (I) forecasting of future power loads; (ii) identifying potential resource options to meet those future loads; (iii) determining the optimal mix of resources based on the goal of minimising future electric system costs; (iv) receiving and responding to public participation (where applicable); and (v) creating and implementing the resource plan. (Responsible Institutions: FMP, TSP, NPC, ECN, NERC, DisCos, GenCos, and REA)

[28] This is based on the Catalogue of Energy Efficiency Measures in ECOWAS Member States developed by the Austrian Energy Agency 2014

- **Building and investing in robust national energy data management toolkit-** Energy data in the country is currently lacking, existing ones are often not in coherent form and are mostly provided by third parties usually regional or global institutions. Energy data sourcing and management would provide necessary link to developing future scenarios and plans for the energy sector. Part of the data should provide in-depth diagnostic analysis to determine both technical and non-technical losses and key mitigation actions encompassing improved management practices and technical measures in the power system of the country. (Responsible Institutions: ECN, NERC, FMP, FMPR, DPR, NNPC, and TSP)

Broadening Human and Institutional Capacity- Taking advantage of various on-going capacity developments in the sector notably the capacity building being provided by the National Power Training Institute of Nigeria (NAPTIN) and other 10 educational institutions across the country to train and develop wide range of technical and non-technical courses on the energy sector with support from Development Partners. Capacity building of financial institutions and energy broking institutions is also very vital. Most financial institutions still do not have clear understanding of the modus operandi of the energy sector especially renewable energy and energy efficiency issues. Training and Capacity Building of financial institution to understand better the risks and how to better assist the development of private sector and community based energy projects is needed, and support activities to accelerate rural electricity connections through REA/SREBs by providing capacity building to States and Local Government areas across the country to improve their energy and resource planning capacity. (Responsible Institutions: NAPTIN, ECN, NEMSA, Universities, and Polytechnics)

- **Nuclear Power:** Evolve a national Nuclear Technology Acquisition Master-plan (NTAM) which will also include the extent of involvement of local industries in subsequent Nuclear Power Plant (NPP) projects.
- Review and update the inventory of relevant industrial and other institutions for effective participation in the nuclear power programme.
- Develop a framework to enhance the participation of local industries in Nigerian Nuclear
- Energy Porgramme (NNEP). This may include:
  i. Funding and supporting the development of prototypes to enhance the acceleration of technology acquisition in all areas of the nuclear power programme.
  ii. Involving monitoring and regulatory agencies to enforce compliance with schedules and standards under NTAM.
  iii. Evaluate technical reports of the monitoring and regulatory agencies, and identify barriers to attainment of targets under NTAM as well as the framework for repositioning.
- To carry out detailed studies/analysis on grid appropriateness for injection of electricity from NPP in collaboration with the vendor.

- To initiate early training of grid operators for inclusion of electricity into the grid from Nuclear Power Plant.
- To deal with the issues of nuclear waste and spent fuel management, there is need for requisite action including:
    i. Early formation of a Waste Management Organization (WMO).
    ii. Approval of the strategy document for the implementation of (P&SF)
    iii. Developing a central RW processing and storage facility
    iv. Siting and constructing a near surface disposal facility
    v. Planning for design and construction of a deep geological repository
    vi. Inclusion of the integrated plan for the construction of waste facilities that is consistent with the nuclear power plant construction programme in the Contractual Agreement.
    vii. A separate agreement between the owner/operator and the vendor will provide a comprehensive decommissioning plan for the plant(s). However, the agreement should take into account the following:
    a) Approval of the decommissioning plan
    b) Ensuring adequate financial provisions at commissioning for decommissioning process.(Responsible Institutions: NAEC, NNRA, and working in collaboration with IAEA))

- The development and adoption of national cooking policies, strategies and targets, including legal and regulatory mechanisms in line with the existing ECOWAS regional policies, the SE4ALL initiative and SDG7 in order to reach market transformation towards modern and alternative fuels and efficient devices to reduce health and environmental impacts. Such national policies should support local manufacturing of improved wood cookstoves, and highlight key incentives for the industry.(Responsible Institutions: FME, NLNG, NNPC, FMST, ECN, FMWA, FMARD, NABDA, working in partnership with Global Alliance for Clean Cookstove (GACC), the West African Clean Cookstove Alliance (WACCA), private sector and civil society).
- Given the importance of Nigeria for the whole of West Africa, Nigeria should be the lead country on LPG thus a clear regional and national demonstration of Government commitment to the recovery of the LPG sector and extended access need to be clearly set out. This action would involve the government and relevant stakeholder (industry players) groups, with each actor's role defined, and target set to be achieved with an agreed time frame. It is recommended that in doing this, the private sector should initiate and carry through the various action plans agreed upon while the government act as the enabler. Domestically, the Federal Government working with other relevant market players should evaluate the feasibility for promoting the use and availability of LPG in rural areas where cooking is still largely dependent on wood fuel usage. Government should ensure that LPG in these remote areas is affordable with safety standards guaranteed. Some possible measure of doing this include-
- Modernizing regulatory frameworks

- Modernizing regulatory frameworks
- Formally adopting of international quality and safety standards
- Improving roads and port infrastructure and reducing port congestion
- Communicating information widely to the public in nontechnical language, specifically, address perception of high risk of LPG use for cooking in households
- Facilitating operator training
- Monitoring to discourage commercial malpractice as well as raise public awareness
- Offer incentives to encourage private LPG retail/service companies to build up distribution network and retail outlets
- Developing financial schemes such that LPG marketers can offer micro-finance schemes, and can lower barriers to LPG selection by making it easier to finance cylinder deposit fees and stove purchases (Responsible Institutions: NNPC, NGC, NLNG, FME, and LPG Trade Association)

2.3.4.1 Relevant High-Impact Opportunities

- Provide regulatory support for scalable and sustainable business and financial models for existing options such as: solar home system development and deployment (including consumer financing); clean energy mini-/micro-grid solutions using both renewables and conventional sources for rural applications, health care settings, solar-powered street lighting and energy for small businesses and agricultural purposes; lighting, charging, and basic electrification; self-contained systems that provide uninterrupted power when the grid fails.
- Recognize consumer needs and provide distributed electricity solutions that support productive use and economic development through local business creation.
- Develop minimum national and regional performance standards for energy products, based on government testing, labelling, and certification (governments and manufacturers).
- Develop and disseminate existing and new approaches and equipment for expanding the grid to larger areas in a cost-efficient manner, while also strengthening and improving the reliability of existing infrastructure (utilities, technology providers)
- Improve smart grid technology solutions, grid-scale storage, and interactions between renewables and fossil fuels to reduce grid losses and support generation from intermittent renewable resources and new load patterns from consumers (technology providers, utilities)
- Build sufficient local and regional implementation capacity to expand grid to new areas and reinforce it where demanded.
- Expand national / regional integration of generation and transmission projects

- and implement transparent transmission/distribution costing mechanisms that drive energy efficiency, and offer a level playing field for connecting energy sources to the grid
- Implement policy frameworks and plans and develop the needed human resources (Government)
- Adopt targets and trajectories for the deployment of nuclear technology using a life cycle perspective
- Establish the consumers of the electricity that will be provided from nuclear and begin to educate and prepare them for its introduction (Government and the industrial sector)
- Craft robust nuclear power policy and power purchase agreements on which nuclear energy developers, utilities and businesses can rely
- Develop and share innovative cost effective design and deployment methods (Technology providers)
- Develop the capacity for the deployment, operation, maintenance and decommissioning to ensure long term economic and technical success
- Develop checklists and toolboxes that allow national policy makers to effectively address the different procedural aspects required to introduce nuclear power into the grid
- Develop monitoring and best-practices sharing and similar mechanisms to spur progress
- Adopt procurement mechanisms and targets that stimulate the local industrial sector to enable their full participation in the nuclear power programme
- Stimulate the survey and characterization of the uranium deposits and technologies for their extraction and processing
- Develop financing schemes to provide credit to households that cannot afford the up-front costs for efficient biomass stoves, LPG burners and other modern cooking equipment
- Develop industry standards for efficiency, safety, and emission reduction, based on testing and certification (Global Alliance for Clean Cookstoves, stove manufacturers)
- Advocate for and educate consumers about the importance and health economic, environmental, and gender benefits of clean cooking through capacity building, awareness campaigns and women's networks.

[31] This is based on the list of HIOs identified by the Global Action Agenda

2.4 RENEWABLE ENERGY

2.4.1 Current Status and Trajectory

As highlighted in Part 1, Nigeria has a huge renewable energy potential that can be used to provide the nation with sufficient capacity to meet both urban and rural electrification and cooking needs. This is essential as the nation seek to increase its on-grid power from 4,500 MW in 2015 to at least 30,000 MW by year 2030. Solar, biomass, and hydro power are the main renewable energy sources that are expected to make significant contribution in this regard. They are mostly available and economically viable to meet various levels of energy needs. Wind potential is good in coastal area but is fair in other locations. Geothermal, wave and tidal, ocean thermal potential remain unexploited.

Although, the nationwide potential for large-scale Renewable Energy projects is immense, existing large-scale grid connected renewable energy projects do mainly exist as large hydropower dams. To date, no real commercial large-scale project has been successfully implemented, other than hydropower. Many Federal and state Government MDAs as well as private sector players have programmes to support and implement various renewable energy technology projects in the near future. Some of the licenses granted at the end of 2014 by NERC are shown in table (23) below.

Table 16: NERC Licenses, Renewable Energy

Name of Licensee	Capacity (MW)	Fuel Type	State	Geopolitical Zone
JAP Energy Limited	504	Biom	Lagos	South-West
Rook Solar Investment	50	Solar	Osun	South-West
Quaint Global Nigeria	50	Solar	Kaduna	North-West
Nigeria Solar Capital	100	Solar	Bauchi	North-East
Anjeed Kafanchan Solar Limited	10	Solar	Kaduna	North-West
Lloyd and Baxter LP	50	Solar	Abuja	North-Central
KVK Power Pvt Limite d	50	Solar	Sokoto	North-West
Pan African Solar	54	Solar	Katsina	North-West
Mabon Limited	39	Hydro	Gombe	North-East
JBS Wind	100	Wind	Plateau	North-Central

Source: GIZ 2014
Note: It is likely that licensees will implement projects in phases instead of implementing

[32] GIZ 2014

Projects of the Federal Ministry of Power- Large Scale Hydro Power Projects

Table 17: Hydropower Development by FMPWH, 2014

No.	Power Station	MW	Zone
1	Zungeru project - Niger St ate	700	North Central
2	Mambilla Project - Taraba State	3,050	North East
3	Gurara II Project - Niger State	360	North Central
4	Gurara I Project - Niger State	30	North Central
5	Itisi Project - Kaduna State	40	North West
6	Kashimbilla Project - Taraba State	40	North East

Source: GIZ (2014)

Further to the above-mentioned projects, the Federal Ministry of Power is engaged in the 10 MW Katsina Wind Project. A contract for the construction was awarded by the Federal Government to a French company with a completion period of 24 months. The project has so far been fully funded and project implementation has progressed despite a few challenges relating to customs clearance at the ports and security on site. The Ministry is currently evaluating the procurement of contractors for the erection of a 33 kV transmission line/sub-station and wire mesh fencing of the project site.

Projects of the Federal Ministry of Environment

- Under the Renewable Energy Programme of the Ministry of Environment, Global Biofuels Ltd is developing a biofuel production complex at Ilemeso in the northern part of Ekiti state of Nigeria. Similar plants are planned to be established at Ondo, Kwara, Osun, Oyo, Kogi, Kaduna, Kano, Zamfara, Benue, Plateau, and Nasarawa.

- Renewable Energy Programme Office, Adamawa State Government and Green Carbon Afrique is developing sugarcane based biofuel plants in Girei and Demsa Local Government Areas of Adamawa State covering 2,000 hectares plantation. This initiative is to produce sugar for local use and export, ethanol and ultimately electricity. This integrated project is being replicated in ten states of the country.

  Working in conjunction with Carbon Quest and Adamawa State, the Renewable Energy Programme office is establishing an integrated Rice Processing and Power Generating Facilitator. This will create benefit for the investing state, by bring home the advantages of large scale rice production and self-generated power from rice-husk.

- Synergent Power share Group of Companies is investing in a 50 MW solar farm in Kaduna, which was officially launched by the Honourable Minister of Environment and Kaduna State Governor in September 2011. There has been no update about the progress of the project.

Currently, the FMWR is engaged in the construction and rehabilitation of 33 dam projects and 27 small earth dams. Seven other major dams with a combined storage capacity of 2,269 million cubic meters have been completed. These are Gurara, Owiwi, Sabke, Owena, and Shagari dams as well as the rehabilitation of Goronyo and Alau dams. Owiwi multipurpose dam was commissioned by Mr. President in 2010. Rehabilitation work on Goronyo Dam has commenced on the emergency spillway which breached as a result of 2010 flooding. In line with the policy directive of government to increase energy supply to meet the nation's energy demands, Federal Ministry of Water Resources is collaborating with the Federal Ministry of Power, with the latter handling the power generation component, while the Ministry handles civil works in all the dam projects with hydropower potentials. Small hydropower schemes have been integrated into some dam projects across the country in order to increase the energy supply of the nation. To date, FMWR has identified and carried out studies on some of the completed and on-going dam projects for hydropower, nineteen (19) of which have the potentials for hydropower generation with a total capacity of 3,557 MW. These dam include; Gurara, Oyan, Ikere Gorge, Bakolori, Dadin Kowa, Tiga, Kiri, Jibiya, Challawa Gorge, Owena, Doma, Waya, Mgowo, Zobe, Kampe, Kashimbilla, Ogwashiku, Zungeru and Mambilla.

2.4.2 Existing Plans/Strategies

National Renewable Energy and Energy Efficiency Policy 2015 The overall objective of the NREEEP is summarized as follows:

i. Security of energy supply- To ensure an efficient energy delivery system with an optimal energy resource mix. Cost competitiveness and environmental protection- To guarantee adequate, reliable, affordable, equitable and sustainable supply of renewable energy at cost-reflective and appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.

ii. To increase investment in the Renewable energy sub-sector and ensure effective coordination and collaboration among all players in renewable energy and energy efficiency activities in Nigeria; and foster international co-operation in trade and project development, in the ECOWAS, African Region and the World at large.

The focus of the policy is to provide a platform for an integrated renewable energy and energy efficiency policy that addresses the important needs of the Nigerian electricity supply Industry (NESI), backed up by an integrated resource plan (IRP) and national action plans. Specifically, NREEEP seek to achieve a renewable electricity target of 16% by 2030 as opposed to the current 1.3%.

2.4.2.1 Renewable Energy Master Plan (REMP) 2012

In an effort to consolidate on the Nigerian Energy Policy 2003 and to reduce the country's sole dependence on fossil fuels and thus improving security of energy supply, the REMP sets out in the short, medium and long terms target the national energy supply mix would be as well as articulate strategic approach and measures to meet the set targets. The REMP is therefore a roadmap for actualization of Government's commitment to create the necessary enabling environment for sustainable energy supply through the deployment of renewable energy for national energy development with active participation of the private sector. It is divided in to programmes with targets, timelines and activities. Incentives to promote the attainment of the programmes as well as generally how the renewable energy market will grow in the country are also provided. REMP outlines 6 main objectives:

- Enhance national energy security
- Expand access to energy especially in the rural areas
- Stimulate employment, economic empowerment and growth and reduce poverty
- Increase the scope and quality of rural services, including schools, health services, water supply, information, entertainment and stemming the migration to urban areas
- Reduce environmental degradation and health risks particularly to vulnerable groups such as women and children
- Improve learning, capacity building, research and development on various renewable energy technologies in the country.

The REMP although not approved yet by the Federal Executive Council, it sets the target for power generation using biomass, solar, hydropower, and wind.

2.4.2.2 National Support for Renewable Energy (Existing and Planned)

Fiscal Incentives- the NREEEP 2015 proposed a set of fiscal and market incentives to support renewable energy deployment. On the short term, the plan includes a moratorium on import duties for renewable energy technologies; the formation of Special Task Force within the Nigerian Custom Services for renewable to mitigate potential difficulties in customs clearance. On the longer run, the plan advises the design of further tax credits, capital incentives and preferential loan opportunities for renewable energy projects.

Financing mechanisms- As regards financing mechanisms and opportunities, Development Finance Institution's (DFI) financing is readily available for utility scale projects that meet the respective criteria as is indicated by some of the projects in the licence approval pipeline. Various commercial banks have indicated the willingness to become involved in RE financing- notable among them is the Bank of Industry who act mainly as 'financial arrangers', for bankable projects.

Tax incentives- Another support programme is the availability of tax holidays for pioneer projects. The Nigerian Government has put in place a number of investment incentives for the stimulation of private sector investment from within and outside the country. While some of these incentives cover all sectors, other are limited to some specific sectors. The nature and application of these incentives have been considerably simplified. Pioneer status is a tax holiday granted to qualified or (eligible) industries anywhere in the Federation and seven-year tax holiday in respect of industries located in economically disadvantaged local government area of the Federation.

The Government encourages investors in the sector with a Tax holiday of 5-7 years, which may be granted to:

- Companies that manufacture transformers, meters, control panels, switchgears, cable and other electrical related equipment, which are considered pioneer products/industries
- manufacturers of solar-energy-powered equipment and appliances c. biomass, large scale mechanised farming (wheat, maize, rice and sorghum)
- energy efficiency schemes, for manufacturers of oven, cookers, cold rooms, refrigerators, fridges, freezers, air conditioner
- utility services (independent power generation utilising gas, coal and renewable energy sources).

2.4.3 Existing Gaps

Table 18: Existing Gaps- Renewable Energy

Aspects	Gaps	
Financial	(i)	Major shortage in investment capital leading to high inte rest rates for renewable electricity.
	(ii)	Initial renewable energy systems for electricity generation are still more expensive than non-renewables in terms of initial investment, but their full life-cycle costs are lower.
	(iii)	RE-specific long payback periods in combination with a low level of investment security result in a high risk premium that increases the cost of capital
	(iv)	Non-implementation or withdrawal of government financial incentives such as subsidies results in low return on investment and project abandonment.
	(v)	Projects requiring counterpart funding often experience delay because of the inability of the country to meet
	(vi)	the required obligation. Weak purchasing power due to the rate of poverty also affects the ability of customers to switch from traditional
	(vii)	energy source to modern/renewable energy technologies. Renewable electricity projects are not common practice, therefore bankers perceive a higher degree of risk and are reluctant to lend – instead they give preference to large-scale conventional electricity investments. Interest rates are generally high and the appetite for long term credits is low among financial institutions,

		especially for non -business -as usual projects such as small - scale renewable power projects. Lack of structured support mechani sms and (sovereign) guarantees for investors
Institutional and Regulatory	(i) (ii) (iii) (iv)	The dominance of the public institutions' involvement in renewable energy activities far outnumbers that of private sector actors. There seem to be conflicts and duplicat ions in mandates especially in relationship between public sector actors due to lack of coordination of activities and responsibilities among the actors. Sometimes, active institutions seem to be pursuing individual mandates which are sometimes cons trued as national efforts to drive activities of the sector. To date, there is no law by the Nigeria parliament to support policy instrument/mechanism approved for promoting renewable energy and energy efficiency in Nigeria; In the past t here is lack of continuity in government policies: there is usually huge uncertainty over policy direction of the government that will succeed the present.
Technical	(i) (ii) (iii) (iv) (v) (vi)	Nigeria has no significant manufacturing capacity for components of renewable energy technologies. Potential IPPs have significant logistical challenges in procuring equipment and maintenance support for renewable electricity projects. There is also the risk of testing imported equipment; national standards that will aid testing procedures are limited in number. Renewable energy applications are relatively new in Nigeria and as such there is the general perception of a lack of trust in untested technologies. There is also inadequate number of professionals in the field of renewable energy in Nigeria. Very limited number of artisans and engineers with skill for renewable energy project execution
Capacity Building and Availability of Information	(i) (ii) (iii) (iii) (iv) (v)	Research and Development capacity is very limited in the country as Nigerian R&D institutions fall short in many respects, e.g. funding, infrastructure, and enabling environment. Lack of practical courses and expertise on renewable energy in major institutions of the country. Lack of trained personnel a nd technical know -how in the sector, i.e. trained manpower requirement to meet the challenges of energy Lack of trained personnel a nd technical know -how in the sector, i.e. trained manpower requirement to meet the challenges of energy demand and supply needs in Nigeria is currently very inadequate. Low level of awareness among private sectors in renewable energy and other related energy projects that could promote low carbon economy. Limited public awareness of the potentials of renewable electricity in meeting some of the energy and development challenges facing the country. The inadequacy of awareness creates a market distortion which results in higher risk perception for potential renewable electricity projects. The general perception is that these forms of energy technologies are not mature and only suited for niche markets.

2.4.4 Actions needed to achieve the overarching objectives of renewable energy

- With the recent approval of the NREEEP by the Federal Executive Council in May 2015, it is important to put in place a strategic implementation framework for the policy and link same with the on-going regional activities, using the vehicles of National Renewable Energy Action Plan (NREAP) SE4ALL AA and SDG 7. Action is also needed to finalise the competitive bidding system currently being designed. This would be very useful in the design and implementation of the Nigerian energy sector investment prospectus. The investment prospectus should have a section dedicated to renewable energy investment in Nigeria. The section should clearly define the following- (i) renewable energy potential and resource plan; (ii) investment and funding needed to develop key renewable energy projects and programs; (iii) identify key stakeholders and partners interested in the sub-sector and seek to create an enabling environment for same.(Responsible Institutions: FMP, TSP, ECN, NERC, NBET, FMWR, DisCos, GenCos, REA, NIMET, GIZ)

- Develop/build a renewable energy data bank and put in place sustainable system of maintaining same through a coordinated working relationship of all relevant MDAs. The data bank should include: a broad investment and decision making tool with clear assessment and mapping of each renewable energy technology potential; viable sites and locations across the country; estimated investment cost required for project development; technology service providers; a renewable energy roadmap that would set out government plans to integrate renewable energy generated electricity into current and planned electricity mix and other relevant information. (Responsible Institutions: ECN, NERC, REA/SREB, TSP, and FMP, FMLHUD, FME, FMWR)

Other notable actions include the followings:

- **Renewable Power Generation:**
  - Completion of on-going projects in Kastina and Plateau States (10MW and 100MW wind farms); 9MW (Oyan dam) and 3MW (Bakolori Zamfara) (FMP, FMWR, NERC, TSP, DisCos, and GenCos)
  - Building capacity for local manufacturing and fabrication of solar PVs, small wind turbines, small hydro power plants, and component parts in Nigeria; and in line with international best practice develop national standards for same (NASENI, SON, NEMSA, NAPTIN, ECN, and ICRC)

- **Grid Infrastructure and Supply:**
  - Using the approved policy instruments (FIT and Competitive Bidding Systems) to create a right enabling environment for a private sector led construction of on-grid, mini-grid, and off-grid renewable energy power

[34] This is based on the list of Actions identified by the Energy Commission of Nigeria

plants across the country (NERC, NBET, FMP, GIZ, **REA/SREB, and Private Sector)**

- **Industrial and Agricultural Processes**
  - Promote and adapt appropriate waste to energy technologies (FMARD, FME, ECN, FMP, NERC, REA DisCos and GenCos).
  - Construct a private sector led renewable energy based energy supply infrastructure for industrial and agricultural processes in various locations across the country (FMARD, and Private Sector).
- **Building and Appliances**
  - Incorporating into the revised building code of Nigeria a mandatory directive for all new builds to be designed in such a way that allows renewable energy systems installations on roof tops e.g. solar panels and water heaters, small scale wind turbines etc. (FMPWH and all its Agencies, FMP, FME, SON, NEMSA, NSE etc.)
- **Transportation**
  - Promote R&D in biofuel for transport sector (ECN, NNPC, FMST NITT, and MAN) Enact and enforce Biofuel usage Act on the use of E5, E10, B10, and E20 in Nigeria (NASS, and FMJ)

2.4.5 Relevant High-Impact Opportunities

Improve and disseminate resource assessment methodologies and develop technical assistance capacity to help the country map resource availability and develop expansion plans:

- Develop and share innovative, increasingly cost-effective design and deployment approaches (technology providers);
- Craft robust renewables policy directives as required by NREEEP 2015 and power purchase agreements on which renewables developers, utilities and business can rely;
- Coordinate grid-connected infrastructure strategies so that different renewable energy project developers do not run into the same barriers;
- Develop capacity for installation, operating and maintenance to ensure long-term technical and economic success;
- Adopt procurement mechanisms and targets that stimulate the market for renewables;

[35] This is based on the list of HIOs identified by the Global Action Agenda

- Develop checklists and toolboxes that allow national policy makers to effectively address the different procedural aspects required to introduce large-scale renewables into the grid;
- Develop monitoring and best-practice sharing facilities and similar mechanisms to spur progress;
- Develop and implement small-scale renewable energy and smart grid solutions for areas where conditions do not allow for large-scale interconnected grids, such as islands or remote areas e.g. facilitate the implementation of the REMU concept;
- Support forecasting of renewable power sources to facilitate integration into the grid and plan for environmentally and economically efficient back-up capacity.

2.5 ENERGY EFFICIENCY

2.5.1 Current Status and Trajectory

Energy efficiency sub-sector in Nigeria has just started receiving significant attention. The National Renewable Energy and Energy Efficiency Policy (NREEEP) was approved in May 2015. The policy placed high premium on energy efficiency and conservation as a means of improving overall access to modern energy service, the policy also recognizes energy efficiency as a resource that could be traded in the electricity market. So far a number of ministries, department and agencies (MDAs) of federal and state governments in Nigeria are beginning to be involved in various aspect of energy efficiency and conservation. Key MDAs active in promoting energy efficiency and conservation include: Ministry of Power, Works and Housing, Ministry of Environment, Ministry of Industry, Trade and Investment, Standard Organization of Nigeria, Nigeria Electricity Regulatory Commission, Energy Commission of Nigeria as well as University of Lagos – National Center for Energy Efficiency and conservation (NCEEC).

As part of their technical assistance programme in Nigeria, UNDP/GEF and GIZ-NESP are currently implementing energy efficiency promotion activities such as: energy efficiency in building (including efficient lighting), industry as well as support in the development of national energy efficiency standards and labels. In addition to these, there has been other energy efficiency activities/programmes in the country e.g.:

- The National Centre for Energy Efficiency and Conservation (NCEEC) attached to the University of Lagos is currently conducting studies into the promotion of energy efficient appliances and light bulbs (details of studies will soon be finalized).
- The Energy Commission of Nigeria (ECN) in partnership with the Cuban government and with support from ECOWAS has been distributing 1 million CFLs in Nigeria free to residents in organized estates across the country.
- The Federal Ministry of Environment's National Clean Cooking Scheme (NCCS) under the Renewable Energy Unit has started production and nationwide distribution of a

purpose designed bio-mass stove in partnership with pot-makers Tower and energy firm Envirofit through its Rural Women Energy Security (RUWES) programme.

- The Rural Energy Access Project (REAP) initiated by the Federal Ministry of Environment's Renewable Energy Programme Unit on reducing power consumption by using clean, energy efficient LED bulbs and introducing household stand-alone solar kits to replace incandescent bulbs, single-wick kerosene and oil lamps as well as small diesel generators.
- The GIZ-Nigerian Energy Support Programme (NESP) - The Energy Efficiency Unit is one of the four components of the NESP aimed at ensuring that the framework conditions for energy efficiency are improved and concrete measures are put in place to generate energy savings. The GIZ Energy Efficiency Unit also seek to improve the policy framework for EE at national level (e.g. EE Action Plan); define and implement standards and further support mechanisms for energy efficiency

  (e.g. AC standard; building code; energy management system for industry); iimplement 5 pilot projects demonstrating the technical and economic viability of energy efficiency in buildings (SWH project in a school in Jos; energy efficient housing estate in Abuja; retrofit of a ministerial building) and industry (2 companies certified according to ISO 50001).

2.5.2 Existing Plans/Strategies

The Nigeria's energy efficiency goals as contained in the National Renewable Energy and Energy Efficiency Policy (NREEP) 2015 is the efficient use of energy for both domestic and industrial applications so energy can be conserved and be used for more productive activities across the country. Thus, the aim of the policy is to further promote a rational exploitation and use of national energy resources. In order to achieve this objective NREEEP requires that National Energy Efficiency Action Plan (NEEAP) be developed within 6 – 12 months of approval of the policy. The NEEAP is to contain energy efficiency targets as well as all policy measures covering efficient lighting, air conditioning, refrigeration, building, industry, cooking and transportation.

Strategies to put the policy goal in practice include the accounting for energy efficiency and saving in electricity tariffs and contracting models, use of incentives, development of energy efficiency building codes, ensuring of importation of the more energy-efficient equipment and machinery, fostering of research and development activities in energy conservation and efficiency, promotion of public awareness about the benefits of improved energy efficiency, requiring for efficiency improvements with regard to electricity transmission and distribution, mandating the deployment of energy saving light fixtures in federal government

offices and facilities, ensuring that the National Building Code requires every new house designed in Nigeria must incorporate energy saving measures, encouraging all buildings in Nigeria to install renewable source of energy as much as possible, implementation of energy audit programme nationwide and enforcement of various standards e.g. ISO 50001 for efficient energy use (GIZ 2014).

Table 19: Existing Gaps: Energy Efficiency

Aspects	Barriers, Challenges, and Risks
Financial	(i) Low energy prices are a dis-incentive for the efficient use of energy. (ii) Major shortage in investment capital leading to high interest rates for energy efficiency appliances. (iii) Non-implementation or withdrawal of government financial incentives such as subsidies results in low return on investment.
Institutional and Regulatory	(i) There is no lead agency on energy efficiency in Nigeria (ii) There is very limited participation of private sector in the drive for energy efficiency - public institutions clearly dominate the sector. (iii) There seem to be conflicts and duplications in mandates especially in relationship between public sector actors due to a l ack of coordination of roles and responsibilities among the actors. (iv) There is no legislation in Nigeria that promotes end-use energy efficiency. As is the case with renewable energy, to date there is no law by the Nigerian parliament that support policy instrument/mechanism approved for promoting energy efficiency in Nigeria; (v) The action of the government in driving energy efficiency is also very limited in most cases; - strict enforcement of law and regulations in energy efficiency is needed. Standard Organisation of Nigeria (SON) does not have standards for energy efficiency of end-use appliances.
Technical	(i) Nigeria has no significant manufacturing capacity for components of energy efficient appliances. (ii) Potential investors face the significant challenge of identifying quality energy efficient appliances; testing laboratories are not adequate. (iii) There is also the risk of testing imported equipment, because national standards that will aid testing procedures are poorly developed; currently, standards and labels are still being developed.
Capacity Building and Availability of Information	(i) Lack of capacity in public sector/government ministries and institutions on how to proceed to implement and enforce energy efficiency regulation in Nigeria. (ii) Very limited support of the activities of the Standard Organisation of Nigeria in developing standards, codes, certification and labels for the Nigerian market. (iii) Lack of sufficient organised research materials and data that will guide the development of policy and legislation to strengthen the efficient use of energy. (iv) Lack of materials to conduct training on energy efficiency. (v) Research and Development capacity on energy efficiency is very limited in the country as Nigerian R&D institutions fall short in many respects, e.g. funding, infrastructure, and testing laboratories. (vi) The concept of energy efficiency in not clear to policy makers of Nigeria. There is a general lack of information, knowledge and interest to understand the nee d for energy efficiency action in the country. Legislators are unaware of the potential savings from embarking on energy efficiency programmes. (vii) Limited public awareness of the cost effectiveness of investing in energy efficient appliances.

2.5.3 Actions needed to achieve the overarching objective of energy efficiency

1. Building and Appliances

- Supporting policies and mechanisms, such as: labels, financial and behavioral incentives, non-grant funding tools, climate finance (e.g. NAMAs) and electric utility market transformation programmes;
- Environmentally sound management including best practices for manufacturing, materials and spent products, to minimize environmental impacts;
- Monitoring, verification and enforcement (MVE) to deter market spoilage by non -compliant products and to ensure the delivery of energy, financial and climate benefits.

2. Industrial and Agricultural Processes

- Formulation and implementation of enabling policies, technologies and integrated strategies that accelerate the adoption of energy efficiency in SMEs;
- encourage adoption of EnMS by companies responsible for 50% of industrial energy use in their territory and promote energy efficiency in energy intensive SMEs;
- Public utilities (or third party program administrators on their behalf) commit to incorporating incentives and technical assistance to support the implementation of EnMS in their demand-side management program;
- Large Industrial companies commit to implementing verifiable energy management approaches, such as ISO 50001 across their enterprise and to share their success stories. They also commit to share tools and training to spread EnMS across their supply chain; Industry associations commit to supporting the roll-out and implementation of sector-specific collaborative frameworks, convening company leadership and action around common energy reduction goals and energy management activities amongst their membership.

3. Transportation

- Introduce measures to improve efficiency of transport fuel use in the country
- Improving road conditions, providing high quality transport fuels and promote eco-driving
- Promote better vehicle technology and improving urban transport systems
- Introduce fiscal policies across the transport sector like feebates that tax inefficient vehicles and provide rebates for efficient vehicles
- Introduce tax-based policies for fuel economy labeling, age limits and import restrictions
- Improving the road infrastructure, developing public transport and traffic plans
- Biofuels blending
- Bio ethanol from cane sugar up to 10% of gasoline mix
- Straight vegetable oil from jatropha up to 30% of diesel mix.

4. Lighting

- Develop minimum energy performance standards to ensure the efficiency, performance and quality of energy-saving lighting products, leading to a permanent removal of obsolete technologies from markets;
- Introduce supporting policies and mechanisms to promote the demand and deployment for energy-saving products, through utility programmes, rebates, favorable scale policies or market based mechanisms (NAMAs).
- Introduce strategic monitoring, verification and enforcement to ensure adequate surveillance of markets and discourage the distribution of non-compliant products.
- Mandate nationwide environmentally sound management of lighting products, to avoid the leakage of hazardous and electronic waste (present in the technologies) into the environment.
- Adoption of Minimum Energy Performance Standards (MEPS) for on-grid and off -grid lighting devices
- Supporting energy efficient lighting policies and measures through awareness raising campaigns targeting final consumers
- Establish a system for Monitoring, Verification and Enforcement (MV&E) of Minimum Energy and Performance Standards (MEPS) for lighting systems;
- Environmentally sound management through the implementation of a collection and disposal system for energy efficient light bulbs

5. Grid Infrastructure and Supply Efficiency

- Transmission grid expansion and voltage upgrade
- Investment in additional MV/LV transformers to develop LV distribution
- Improve customer database to monitor consumption Gas power plants efficiency by- Ensuring that the gas supply is dry; Retiring obsolete gas turbine technologies; and Shift from open cycle gas turbine to combined cycle.

6. Energy Efficiency Standards and Labels

- Minimum Energy Performance Standards (MEPS) that specify minimum energy efficiency levels products, e.g. CFLs, must meet before they can be legally sold in the country;
- Ensure specific energy standards are set before products are allowed into the country and sold;
- MEPS are mandatory standards and are done in a manner that they balance technical possibility with economic viability and the competitive force within a particular market
- The Standards Organisation of Nigeria (SON) should publish standards relating to energy efficiency, such as a code of practice for the deployment of outdoor solar lighting systems, electrical installations of buildings, and a standard for safety and performance of CFLs; SON should also organise conferences and training for industries on standards and support organisations in the understanding and use of same.

2.5.4 Accelerators

Table 20 : Relevant Energy Efficiency Accelerators

1. Appliance and Equipment Accelerator o Monitoring, verification and enforcement (MVE) to deter market spoilage by non-compliant products and to ensure the delivery of energy, financial and climate benefits
2. Building Efficiency Accelerator o Approval and Implementation of the national energy efficient building code that encourages the use of best available technolog ies, low energy building design and energy efficiency renovations that will deliver up to 25-50% reductions in energy demand from new and existing buildings.
3. District Energy Accelerator o Undertaking energy mapping and infrastructure planning across the country; o Establish economic and technical viability of all district energies across the country; o Develop tailored policies and business models o Create public awareness and engage stakeholders necessary for effective project implementation
4. Lighting A ccelerator o Efficient lighting (residential, public building and street lighting) o Efficient cooling (fridge, commercial and industrial) o Efficient electrical appliances through labelling o Thermal regulation for building
5. Transport and Motor Vehicle Fuel Efficiency Accelerator o Adopting additional fuel saving technologies specially addressing the lagging improvement in fleet fuel economy as a result of the vibrant second hand vehicle market o Improving the road infrastructure, developing public transport and traffic plans
Industrial Energy Efficiency Accelerator o Implementation of ISO 50001 MEPS in SMEs; o Large Industrial companies commit to implementing verifiable energy management approaches, such as ISO 50001 across their enterprise and to share their success stories. They also commit to share tools and training to spread EnMS across their supply chain;

[36] This is based on the list of Global Energy Efficiency Accelerators Platform

2.6 ADDITIONAL NEXUS ACTION

2.6.1 Current Status

With the current transformation of the Nigerian electricity sub-sector, energy demand and supply is expected to more than double compare to current capacity by 2030. Similarly, it is estimated that with an average population growth rate of 2.5% Nigeria population could reach 230 million by 2030. The Federal Government of Nigeria seeks to balance the demand for energy and other competing resources- food, health, gender, education, and water. The Federal Ministry of Water Resources (FMWR) the custodian of the Nigerian Water Supply and Sanitation Policy 2004 states that about 3.14 million hectares of land is available for irrigation in the country thus the policy sets out objectives in order to balance this need and food production. Currently (2015) it is also estimated that only 63% of the Nigerian population have access to clean water. Recognising this challenge, the government seek to increase this estimate to 85% by 2020. For Nigeria to meet this target it is estimated that US$1.7 billion (rural water supply (RWS) =US$604 million), urban water supply (UWS) =US$1.1 billion) is needed annually.

- **Electricity:** the FMWR also liaise with the FMP in balancing the need for dams for electricity generation and water supply. Currently, the FMWR undertake all the civil work in dam construction for electricity generation in the country. Similarly under the draft Rural Electrification Strategy and Implementation Plan (RESIP) a total of US ($) 9 billion is budgeted by the federal government to meet the 2020 rural electrification target. This budget also include the provision of basic electricity services for health care centres, lighting of rural educational areas, and providing basic solar and wind water pumping system for rural communities.

- Food Production: In order to make utmost use of available resources and to avoid waste the Federal Executive Council has recently approved the Agricultural food processing zone policy. This is to streamline processes of food conversion and storage processes throughout the country. However, it is needful that an energy sector land use policy be designed and implemented to address the competing circumstances between food production and energy supply i.e. balancing the need for land to grow feedstock for energy fuels and land for growing food for consumption.

- **Health and Gender:** Efforts are on-going by the Federal Ministry of Environment and international partners to reduce death rate in rural areas as a result of the use of woodfuel for cooking. The RUWES programme of the Ministry and other interventions e.g. the distribution of clean cookstoves and wonderbag across the country are all laudable efforts. However, at Federal level, it is important to develop a national gender and energy policy that aligns with regional gender policy.

[37] An AMCOW Country Status Overview: Water and Sanitation in Nigeria (2011)

2.6.2 Actions Needed

- A policy and regulatory framework is needed to (i) Promote national frameworks to support cross-sectoral coordination through the inclusion of clean cooking across sectors (health, energy, environment, gender, economic development, education and training, forestry, rural development etc.). For instance, consultation through inter- ministerial task teams; (ii) Promote differentiated strategies to make clean fuels and technologies accessible and affordable across different market segments, increasing the number of consumer choices with regard to both cookstoves and fuels that meet the unique needs of consumers.

- Development of new biomass energy sources (e.g. pellets, briquettes, biogas, as well as liquid fuels, such as ethanol, produced from agricultural or forestry wastes) and create a self- sustaining entrepreneurial network of rural micro-enterprises for delivery of improved biomass fuels. Measures to achieve this objective could be, among others:
    - Conducting training courses for new entrepreneurs wherever required
    - Conducting refresher courses for successful entrepreneurs
    - Promotion and marketing activities, e.g. village level awareness camps and programmes organised to create marketing opportunities for the new enterprises
    - Ensuring quality of the products through continuous monitoring and evaluation
    - Encouraging local banks and financing institutes to support the new businesses
    - Establish use of improved biomass fuels as a common practice rural households
- A gender responsive measures is also needed for the- (i) Integration of gender aspects in national planning, and strategy- and decision-making processes (ii) Develop gender responsive actions and economic empowerment of women Measures to achieve this could be:
    - Involve women in the conceptualization, development and implementation of energy policies, projects and programmes as much as possible
    - Produce promotional messages to address the gender issue and attempt to form partnerships with women's groups (or NGOs in the area) Develop programmes to train young women to produce, operate and maintain equipment on their own
    - Develop and implement gender-responsive national policies and programmes on clean and efficient cooking

[38] This is based on the Catalogue of Energy Efficiency Measures in ECOWAS Member States developed by the Austrian Energy Agency 2014

- Economic empowerment of women through their increased involvement in the cooking energy value chains
- Capacity building of policy makers and practitioners to integrate gender in their cooking energy policies and programmes Integration of gender indicators in all

2.6.3 Relevant High-Impact Opportunities[39]

- Clean energy mini-/micro-grid solutions using both renewables and conventional sources for rural applications, health care settings, solar-powered street lighting and energy for small businesses and agricultural purposes;
- Innovate on technology solutions that improve overall efficiency (energy productivity) and reduce/eliminate standby/phantom electricity losses;Deploy and use advanced technologies to enable energy-saving behaviour and raise customer awareness about simple steps to reduce energy demand from everyday products and through energy efficiency labelling schemes; develop
- Advocate for and educate consumers about the importance and health economic, environmental, and gender benefits of clean cooking through capacity building, awareness campaigns and women's networks;
- Deploy and scale up energy management systems and tools for reducing energy use E5) capture and redeploy wasted energy and heat, including natural gas that is now burned off through 'fiaring';
- Convert to biomass and other renewable sources in industrial processes where possible and sustainable over the longer term, including for co-generation;
- Provide sustainable energy access to agriculture, educational centres, community health centres, and SMEs;
- Address the energy-water nexus through renewables-based desalination and energy-efficient irrigation pumps;
- Improve access to modern energy services through integrated food and energy production

2.6 ENABLING ACTION AREAS

2.6.1 Energy Planning and Policies

Despite substantial efforts and progress in implementing the reform of the energy sector, Nigeria's renewable energy, energy efficiency and energy access sub-sectors are still characterized by several challenges such as: limited power generation capacity, a widespread inefficient use of electricity, low electrification rate, and limited finance to undertake bankable projects. This is inter alia due to a lack of adequate policies to drive investment and overlapping mandates of the various actors in the sector, leading to an incoherent policy and institutional framework**.** From 2001 to date, more than thirty (30) draft policy documents on energy access, renewable energy, and energy efficiency have been formulated by various actors. However, only very few of these policy documents have been approved and enforced to date. The majority of the documents are (draft) strategies and policies that partly overlap and partly contradict each other with very few acts, regulations, standards and norms that would serve to implement the overarching strategies. This leads on the one hand to an in-transparent policy framework with various overlapping institutional mandates; on the othe hand implementation is seriously hampered due to the increased risk in investment in the sector, giving an explanation for the difficult situation of the Nigerian energy sector. Therefore, there is need for a carefully thought through energy plan that cut across all the energy sub-sectors. Its design should also strengthen the gains of current reforms and improve relationship among sector actors (public and private) and further lead to implementation of policies and projects

2.7.2 Critical Areas

National energy plan that clearly defines future energy plans of the country and presents information on available sources of investment finance. Although ICREEE exist at inter-ministerial levels and NACOP at the national level, it is still very much unclear who has the lead mandates among tiers of government, ministries, and agencies. Prior to the recent privatisation the public sector dominated the Nigerian energy sector leaving the other stakeholders including State governments and local governments with limited involvement.

2.7.3 Actions Needed

- The federal government of Nigeria through relevant MDAs, State Governments, and other stakeholders should seek to work and agree on modalities to develop a robust national energy plan and policies (ECN, FMP, FME, FMWR, FMPR, NPC, FMST, FMLHUD and Development Partners) Strengthen the National Council on Power (NACOP) which is chaired by the Minister of Power and similar councils so as to engage with wide range of stakeholders in the design and regulatory process of the national energy plan (FEC, FMPR,

stakeholders in the design and regulatory process of the national energy plan (FEC, FMPR, FMP, and ECN)

The lack of access to comprehensive, accurate, and reliable information on the energy sector and regulatory landscape in Nigeria is a significant barrier to both public, private sectors, and other stakeholder group participation, consequently: There is need to create a constant updated data base (National Energy Catalogue), to show case and update the priorities of the sector, the on- going and perspective activities of all actors (private and public) in order to avoid overlaps and duplication of efforts; develop a national energy sector portal i.e. a web- based portal that will be a one-stop window containing information on all the licensing requirements from the different issuing agencies as well as agencies that provide associated information on energy projects, including prerequisites for application, fees and charges, expected processing time, contact persons and offices location, renewable energy electricity tariff structures, status and overview of the energy sector etc. The consolidation of this information will ease the burden of project preparation and reduce transaction costs on the part of developers. A close collaboration with key government agencies will ensure that the portal has current and accurate information at all times (ECN, NERC, NBET, NEMSA, REA/SREB)

2.7.3 Business Model and Technology Innovation

2.7.4.1 Critical Areas

A key outcome of the just concluded privatisation of the electricity sector indicates that the private sector is now actively involved in the activities of the energy sector in Nigeria. The privatisation saw the transfer of publicly owned power plant to private companies. A business model for rural electrification is also been worked out by the Federal Government through the Federal Ministry of Power. The REMU is currently being piloted in few locations across the country so as to come up with viable framework for successful handover to the private sector. GIZ through its NESP project in Nigeria is also working with 5 states of the federation to further strengthen the process of off-grid renewable deployment in the country.

2.7.4.2 Actions Needed

The federal government through relevant MDAs in joint effort with stakeholders should clearly develop a streamlined investment strategy for large IPP projects to ease-off any barrier. Such investment strategy should form part of the energy sector investment prospectus for the country (NIPC, NPC, FMP, NERC, NBET, FMF, CBN)

- There is need to strengthen REA's activities by adopting and implementing the Rural Electrification Strategy and Implementation Plan thus, offering domestic companies the opportunity to partake in the competitive process of the electricity sector (FEC, REA, NERC, FMP)

As stated in the NREEEP, major bottlenecks in the imports of the RE and EE equipment

- As stated in the NREEEP, major bottlenecks in the imports of the RE and EE equipment should be removed by having a standardised legal instrument for all import and export processes; review existing duties and taxes of electricity supply industry equipment to make it more investor friendly (FMF, Nigerian Customs, NERC)
- Since there is no real business model that currently exists for EE and EA subsectors, it is important that ICREEEE and relevant MDAs (including States and Local Governments Agencies) should work on developing business strategy that clearly encourage and allow private sector participation. (FMP, FMLHUD, FME, ECN, REA/SREB, FMWA, NOA, ICRC and Private Sector/NACCIMA)

- In line with the business opportunities established by GIZ Study on solar water heating application in Nigeria, there is need for the federal ministry of lands, housing and urban development and other relevant MDAs and stakeholders to develop a comprehensive market strategy and business model for domestic application of the technology (FMLHUD and Agencies, NSE)
- A nationwide public campaign and enlightenment for the use of improved cookstove, LPG, and other modern cooking technologies will be helpful to promote a national switch from the current traditional system of cooking to a low carbon system (NOA, FMWA, and Gender related Civil Societies and NGOs)
- Notably, there is only one cookstoves test centre in the country. There is need to develop more test centres to ensure high quality products are produced and sold in the Nigerian market place (FME, SON, NESREA, ECN, and GACC).
- Develop and promote local capacity in the nation's energy centers, tertiary institutions and research institutes for innovations in the design and fabrication of energy efficient and renewable energy technologies (NERC, NBET, TSP, FMP, NAPTIN)
- Integrate Pre-payment and power management in the off-grid micro utility to help in revenue collection and minimise commercial losses (REA, FMP, NERC)

2.7.3 Finance and Risk Management

2.7.3.1 Critical Areas

Although financial institutions of the country are becoming aware of the importance of investing in the energy sector, their willingness to provide necessary funds for the off-take of renewable energy and energy efficiency projects at competitive rates is still very unclear. As it stands, energy related projects still attracts high up front capital which possess a huge risk for investment into the sector. For projects where finance is available, it comes at high interest rate and collateral requirements making it almost impossible to have robust feasibility cost analysis. Some of the financial incentives enumerated in the

have robust feasibility cost analysis. Some of the financial incentives enumerated in the NREEEP 2015 are also very useful to drive market and investment in the renewable energy and energy efficiency sub-sectors.

2.7.5.2 Actions Needed

- Setting up a project developer and financial institution forum where business and finance issues can be discussed including how to identify bankable projects and linking same to available source of fund (CBN, Project Developers, FMP, FMF, NPC, NIPC,REA, Commercial Banks and Equity Funds Providers).
- Establish clear legal and regulatory framework for energy financing in Nigeria (CBN,FMF, ICRC, WB, Commercial Banks)[52]
- Establish Infrastructure Project Development Facility (IPDF) to finance the development of a pipeline of bankable projects (CBN, FMF, ICRC, WB, Commercial Banks)
- Establish long term financing mechanisms for- energy asset; corporate bonds, and venture capital (CBN, FMF, ICRC, WB, Commercial Banks)

2.7.6 Capacity Building and Knowledge Sharing

2.7.6.1 Critical Areas

The recent changes and transformation in the energy sector brings to the challenge of expanding the sector's institutional capacity. Renewable energy and energy efficiency issues are already a priority on the government's agenda due to the huge potentials across the country. However, there are very limited professionals and institutions where necessary training and capacity development can be delivered. Public awareness of these technologies is either very poor or negative due to past poorly implemented projects. In addition to institutional capacity, local manufacturing of energy efficiency components are also lacking. Awareness and training is also needed for public and private sector on advancing the current reform of the energy sector. Without a broad improvement in public and “grassroots” private sector engagement in renewable, clean and efficient technologies it will be impossible to meet many of the goals of SE4ALL. Thus investment in engagement with civil society and the private sector (small business) focusing on their potential as early adopters of new technology. In conjunction with this engagement educational institutions should be prioritized as “showcase” environments for new technology and energy efficiency with high schools and tertiary institutions being the most obvious platforms for large receptive audiences.

[40] This is based on the Actions identified by the Energy Commission of Nigeria
[41] This is based on the Actions identified by the Energy Commission of Nigeria
[42] This is based on the Actions identified by the Energy Commission of Nigeria

2.7.6.2 Actions Needed

- Manpower development and training made available for professionals in the sector e.g.by strengthening the mandate and activities of the National Power Training Institute of Nigeria (NAPTIN) and other relevant training institutions. Notably, Component 4 of the GIZ NESP programme is about capacity building in the energy sector. Courses currently developed and delivered should be properly managed and consolidated upon so as to ensure continuity and integration of trained professional into the sector.
- An intensive nation-wide capacity need assessment and gaps should be undertaken and recommendations on how to strategically fill all gaps identified (NBS, ECN,NAPTIN)
- Fund "high visibility" renewable energy and energy efficiency pilot projects in educational institutions (high schools and tertiary prioritized) with accompanying educational campaigns and linkages to household and basic access energy opportunities for communities (FEC, Development Partners, FMF, FMP)
- Develop a Federal Government led SE4ALL forum that co-ordinates government, civil society, and private sector support to public education on SE4ALL programs and regularly examines the accessibility and effectiveness of program reach to target sectors [especially rural communities and households] (FMP, ICREEE)
- Modules on energy access, energy efficiency, renewable energy, and nuclear should be introduced and integrated into primary school, high school and Nigerian higher institution curriculum (FMEd., NAPTIN, NUC, NBTE, UBE)
- In conjunction with civil society and private sector associations engage in public enlightenment and media awareness of the public on the benefits of deploying renewable energy, nuclear energy, and energy efficiency applications (NOA, FMWA)

It is also necessary to design sustainable capacity building programmes to enhance institutional capacities in order to use the full potential and the opportunities to achieve a sustainable result. There is need for high level executive decision/policy makers to understand the role of clean energy technologies and sustainable energy policy and planning process in the economic and social development of the population. Consequently, there is need to design various customised capacity building programmes in clean energy technologies, rural electrification and energy policy implementation process for the various actors. Furthermore, a pool of experts should be established to provide ad-hoc advice and support on specific technical issues to governmental institutions.

PART 3: COORDINATION AND FOLLOW-UP

3.1 NATIONAL SE4ALL COORDINATION STRUCTURE

The Nigerian SE4All action agenda is heavily drawn from the contents of the Nigeria's NREAP and NEEAP, which was supported by the ECOWAS Centre for Renewable Energy and Energy Efficiency. It will be recalled that at the 43rd Ordinary Session of the ECOWAS Authority of Heads of State and Government, held from 17 to 18 July 2013 in Abuja, Nigeria, Nigerian President led 15 other Presidents to adopt the ECOWAS Renewable Energy Policy (EREP) and ECOWAS Energy Efficiency Policy (EEEP). These regional policies were developed by the ECOWAS Centre for Renewable Energy and Energy Efficiency (ECREEE) and adopted by the Member state, require that all fifteen ECOWAS Member States shall develop National Renewable Energy Action Plans (NREAPs) and National Energy Efficiency Action Plans (NEEAPs) by the end of 2014. Following the official launching of the SE4ALL by H.E. Ban Ki-moon, UN Secretary General, the ECOWAS authorities also mandated ECREEE to act as the ECOWAS focal point for the Sustainable Energy for All Initiative (SE4ALL) especially with the development of the SE4ALL Action Agendas. Similarly, Nigeria's President in year 2012 launched the Sustainable Energy for All (SE4ALL) Nigeria initiative in line with H.E. Ban Ki- moon's passion towards energy access for all by 2030. This singular act puts Nigeria among the first nations in the world to embrace the initiative that is now widely celebrated. However, a high level coordination structure and follow-up mechanisms in terms of reporting and monitoring arrangement is needed to drive this whole process.

The management of Nigeria's SE4All Action Agenda will be built on existing structure of the already established Inter-Ministerial Committee on Renewable Energy and Energy Efficiency (ICREEE). Nigeria's SE4All Action Agenda will be fully integrated into the activities of relevant MDAs under the umbrella of ICREEE, which is under the leadership and coordination of the Federal Ministry of Power (FMP). The rational for this structure is to bridge the gap of the lack of coordination and conflict among various Ministries, Departments and Agencies (MDAs) especially with regards to energy access, renewable energy, and energy efficiency matters. Therefore there is an immediate need for the Federal Government to put in place the SE4ALL Secretariat, within the Federal Ministry of Power, who is the focal point for a Nation's SE4ALL activities. Within the secretariat a SE4ALL Steering Committee should be established as well to provide support to the Secretariat. Members of the Steering Committee will include the ICREEE team, FMF, FMEdu, CBN, TSP/SO/OM, State and Local Governments, DisCos, and GenCos. International Partners EU, GIZ, ECREEE, UNDP, AfDB, Civil Society Representative, National Banks, Private Sector, SME Reps etc. will serve as Donors Executive Committee.

For improving both communication and participation, the Donor Executive Committee will incorporate private sector and civil society representative(s). The Steering Committee will meet monthly and provide support and advice to the SE4ALL Secretariat.

3.2 Nigeria's SE4ALL Secretariat

The Secretariat is the AA's lead advocacy and managerial unit of the country. All SE4All related projects and studies would remain under the responsibility of the Secretariat and liaising with all relevant Ministerial Department and institutions.

The Secretariat is responsible for realizing Nigeria's SE4ALL goals, as it coordinates multi-stakeholder initiatives, programs and projects; it creates and increases awareness, monitor and report on the country's progress towards the SE4ALL goals. The Secretariat is responsible and accountable for managing the implementation of the AA, the Investment Prospectus and the M&E plan. The Secretariat is Nigeria's focal point for exchanging information with the SE4ALL global initiative, especially with the SE4ALL Global Facility Team, the SE4ALL Africa Hub, the SE4ALL Thematic Hubs, each HIO's and Energy Efficiency Accelerator's coordinator or coordinating group. The Secretariat will present for approval to the Honourable Minister of Power, draft modifications to the AA and propose any other “mid-course” adjustments that may be needed to keep Nigeria on its critical path to achieve its SE4ALL goals.

Figure 19: Nigerian SE4ALL Action Agenda Coordination Structure

3.3 Organizational structure of the SE4All Secretariat & Roles

The Secretariat will be based at the Federal Ministry of Power, and will report directly to the Honourable Minister of Power and inform the SE4ALL Steering Committee (ICREEE team) and the Donor Executive Committee. It will be headed by the National Focal Point and supported by a dedicated team drawn from the Renewable Energy and Rural Power Access Department of the Federal Ministry of Power i.e. personnel of the Secretariat will be employees of the Federal Ministry of Power however; Technical Advisors will be secured to support the SE4ALL Secretariat on a regular basis.

The Secretariat will be funded by budgetary allocations and donor funds received for SE4ALL related activities. The National Focal Person will lead the Dedicated Team and will serve as lead programme manager of the AA, and will support implementing of the AA resources in general and advise the SE4ALL Steering Committee and the Donor Executive Committee where the best opportunities for delivering the SE4ALL AA outcomes are and how the required investments can be made and managed to ensure maximum returns. The National Focal Point Person will be responsible for the monitoring and working with project implementation partners identified in the AA. The National Focal Point/Coordinator will facilitate project interventions, coordinate across agencies and institutions activities such as, but not limited to, project implementation, feasibility studies, consumer and end- user research, work plan preparation and monitoring of results.

The Secretariat will coordinate the activities of ICREEE, States and Local Governments, and liaise with other MDAs whose activities and mandate impact on the SE4ALL AA goals. The main object of this task is to track the level of coverage in terms of access, energy efficiency and renewable energy at all levels and periodically update progress on each State of the Federation and aggregate the local government's coverage to come up with the national performance of Nigeria under SE4All. Thus the role of the Secretariat is divided into three main parts;

3.3.1 Nigeria's SE4ALL AA implementation hub

- Coordinate and manage renewable energy, energy efficiency, and SE4ALL development, and endorsement process, and inform the Minister/Permanent Secretary on progress and emerging key issues; and Support the Federal Government in the mobilization of financing for the implementation of SE4All AA.
- Act as a focal point to manage national cross-sectorial and multi-stakeholder consultation inputs; organize seminars/workshops for all stakeholders at key moments of the implementation of the action plan to keep all sector engaged, increase awareness and gather feedback that can be used by the Secretariat for

the purpose of its annual review of the Action Plan.

- In conjunction with stakeholder consultation the SE4ALL Secretariat should co-ordinate efforts to work with civil society and SMEs to promote widespread understanding of SE4ALL goals and opportunities for households to engage with key elements of small scale renewable energy, cookstoves, and energy efficiency
- Work with civil society organizations, indigenous solar companies and educational institutions to identify pilot opportunities that will improve the visibility of renewable and energy efficiency in institutions and highly visible business areas.
- Work with MDAs, civil society, and key stakeholders to incorporate educational material into both the curriculum of schools and their educational programming
- Act as the national hub for liaising with regional and global partners; and as the focal point for high-level communication dissemination of information, and outreach for renewable energy, energy efficiency and SE4All action agenda.

3.3.2 Monitoring the AA progress

- Conduct the assessment of the baseline to document on the availability and use of energy at Federal, States, and Local Government level to define the conditions of access to modern energy services, renewable energy use and improvements in energy efficiency
- Monitor progress in the implementation of each of the retained actions under the SE4All Action Plan;
- Coordinate the collection of data from the various Government Agencies and Development Partners to monitor progress
- Disseminate the monitoring data to all relevant stakeholders
- Recommend inputs for each annual review of the AA, identify gaps and suggest solutions that ensure the progress of the SE4ALL implementation

3.3.3 Information Dissemination and Knowledge Sharing

- Nigeria's SE4All Resource Data Base:
  - Statistics;
  - Sector Information, including maps, atlases, measurement records, legislation, development plans, policy documents;
  - Project preparation reports (preliminary assessment, pre-feasibility, feasibility reports, project appraisal reports of Development Partners);
  - Collect and disseminate project data amongst development partners involved in SE4All and to the wider public.

3.4 Monitoring, evaluation and reporting

A core responsibility of the SE4ALL Secretariat domiciled in the Federal Ministry of Power is to coordinate the activities of ICREEE, liaise with other relevant MDAs, State, and local governments (National Council on Power (NACOP) and other national, regional and international stakeholders to ensure wide coverage and information dissemination across board and facilitate stakeholder participation in the implementation of the SE4ALL Action Agenda of the country. In addition to the task enumerated earlier, the SE4ALL secretariat will need to develop mechanism to access the current stage of energy usage and application across the three tiers of government (Federal, State, and Local Government) and through a wide stakeholder consultation define the conditions of access to modern energy services and seek ways to improve them. The Secretariat will also be a one-stop-shop with responsibility to prepare regular monitoring, evaluation plan, and progress report to guide high level government decision in EA, RE and EE issues. A comprehensive M&E Plan ensures proper implementation of the AA, tracks achievement of results, and assesses the effectiveness and impact through the timely and consistent collection and analysis of comparable data. From the wide range of data obtained key includes performance measures to monitor each level of the SE4ALL Implementation logical framework and actions should be developed. The Secretariat will lead the collection of baseline data with shared responsibility with the Steering Committee and the Donor Executive Committee.

3.5 FOLLOW-UP AND REVIEW PROCESS

Drawing from the experiences of the process of developing the Action Agenda, it is very clear that huge gaps exist in the Nigeria EA, RE, and EE sub-sectors especially if the 2030 goals are to be achieved. Similarly, though the government efforts in transforming the country's energy sector is laudable, significant efforts is still required both on the part of the public, private, and civil societies to consolidate the benefit of the privately driven sector. The AA is conceived as a live document that will be adapted and updated as progress is monitored and reported, and new actions become more relevant and others are completed or the gap that prompted such action was overcome. Therefore, there is need for additional follow-up analysis in the following areas- (i) there is need to develop a strategic data collection, analysis, and management system that will serve as a basis for future work on the EA, RE, EE sub-sectors. Lack of reliable data hinder and forestall good forecast and projections. A reliable form of data collection and analysis will not only strengthen investment in the Nigeria energy sector but will also ensure best practice and accountability across the sector; (ii) There is need to review existing renewable energy and energy efficiency actions plans and develop a more comprehensive plans with clear targets and timelines.

To mitigate the challenge of monitoring and assessing the impact on AA targets the SE4LL Secretariat will implement a review process based on the integration of the results of its own M&E procedures and inputs from mid-term and final M&Es of on-going programs and projects. The AA will be subject to an annual performance assessment, which will focus on the progress of the specific activities being implemented each year. Its output will include recommendations for the annual agenda of the following year, and inputs for the impact assessments that will be done at the end of each of the major cycle of the AA. It is recommended that the SE4ALL Secretariat domiciled in the Federal Ministry of Power undertake two annual performance reports submitted to the Honourable Minister/ Permanent Secretary Federal Ministry of Power: (i) Mid-year progress report aimed at informing the Steering Committee, Donor Executive Committee, and other stakeholders of the progress of each of the programs relative to the targets, explain the variances and describe the actions to be undertaken to meet the targets; using the mid-year report as a yardstick and with the submission of progress report from the Steering Committee to (ii) provide a substantial analysis of the implementation of each program over the past 12-months (progress made, challenges, corrective measures, lessons learnt, etc.). It will be submitted soon after year-end, discussed with the stakeholders, and commitments made for the upcoming year.

PART 4: DESCRIPTION OF THE ACTION AGENDA PROCESS

The process of the development of the SE4ALL AA started in March 2014 with the Regional kick-off meeting in Abidjan, Cote 'd' Ivore when 15 ECOWAS member states including Nigeria validated the Action Plans and Action Agenda Templates and adopted a regional process for the development of the National Renewable Energy Action Plan (NREAP), the National Energy Efficiency Action Plan (NEEAP), and the SE4ALL AA. The regional process is summarized into three phases as presented in Figure 20.

Figure 20: Process for Development of the Action Plans and Action Agenda

- **1ST Phase**
  - Development of the templates and procedures for the Action Plan Proces
  - Kick off and validation meeting of the regional process and the templates of the action plans for SE4ALL, RE and EE including a training in Abidjan, March 2014
  - Contracting national consultants to assist MS with the development of th Action Plans
  - Establishment of a backstopping team of international experts to provide on-going support
- **2nd Phase Development of the Action Plans at National Level**
  - High Level Kick-Off Meeting
  - Baseline Data Validation Workshop
  - National Stakeholder Consultations/Meetings (throughout the process)
  - National Validation of the Action Plans
- **3rd Phase**
  - Implementation and monitoring of the Action Plans and AA at national and regional level – 2020/2030

Arising from the regional template and phases described above, Nigeria's Action Plans and Action Agenda development phase took the following process described in Table 21 below

Table 21: Nigeria Action Plans and Action Agenda Development Process

- Kick-off Meeting- Abidjan March 2014
- Steering Committee/ICREEE Meeting- 6th May 2014
- Inception Meeting with Ministers of Power and PS- 15th May 2014
- Thematic Working Groups Set Up- 2nd July 2014
- Thematic Working Groups Meetings: July - August 2014
- High Level Kick-Off of the AP and AA during 1st NACOP - 14th August 2014
- Stakeholder Meeting/Validation Workshop- 12th September 2014
- Development of Baseline Report - September to October 2014
- Submission of Draft Baseline Report, NREAP, and NEEAP to ECREEE- Nov. 2014
- Backstopping Expert Review and Feedback- Jan 2015
- Development of SE4ALL Action Agenda- February -May 2015

- Stakeholder Consultation Meeting- 15th June 2015
- ICREEE MET AND ADOPTED THE NREAP, NEEAP & SE4ALL AA – 13TH AUGUST 2015
- High Level Adoption/Validation during 2nd NACOP 14th July 2016 in Kaduna, Nigeria

Next Steps

Following the validation and adoption of the SE4ALL AA Nigeria, the process of the development of the Investment prospectus (IP) will commence. The IP seeks to operationalize the country's AA. It aims to achieve the SE4ALL goals by identifying and developing a set of implementable programs and projects, including their investment requirements, which can be presented to potential private and public investors. It is a time-bound short-to-medium term document which presents an integrated set of prioritized and sequenced investment opportunities. It integrates the technical, financial, and implementation requirements for achieving an intermediate goal and delineates the annual funding requirements for capital investments, technical assistance and capacity building over a given time frame. It also identifies policy frameworks or government priorities relevant to reaching these outcomes.