ENERGY AND POWER DEVELOPMENT IN NIGERIA: PROSPECTS, CHALLENGES AND WAY FORWARD*

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1. Introduction

- I feel honoured and privileged to be invited by the Management of the Federal University of Technology (FUT), Minna under the able leadership of the Vice Chancellor, Prof. M.A. Akanji to deliver the 2014 pre-convocation lecture. I congratulate Mr. Vice Chancellor and staff of this great University for being able to graduate students, and to arrange a convocation ceremony for them. It is my prayer that this success shall be sustained throughout the tenure of office of Mr. Vice Chancellor.
- Ladies and Gentlemen, the letter of invitation sent to me requested that I talk on a subject matter, which "revolves around the challenges of power reforms currently on-going".
- However, since electricity commonly referred to as power is derived from primary energy sources of fossil, renewable and atomic energy. I therefore felt necessary to expand the presentation to cover reforms in the entire energy sector, which deals with the two different but inter-related phenomena of energy and power. I shall look at where we are from; where we want to go; how far we have gone; the challenges there from and to suggest way forward with regards to reforms in the energy and power sector in Nigeria.

1. Introduction Cont'd….

- Ladies and Gentlemen, energy as we all know is technically defined as the capacity to do work, whereas power expresses the rate at which work is done. Thus energy and power are not synonymous, technically. You need energy to be expended overtime before you can have power. Energy changes form, while power does not. It is an instantaneous quantity. Energy can be stored, while power cannot be stored. It is said that if something has to happen, energy must change and power measures how fast the energy change occurs.
- Electricity like fuels and process heat, is one of the final energies useful in driving national economies and social development worldwide. Figure 1 shows graphically the relationship between Gross Domestic Product (GDP) per capita and electrical energy consumption per capita of nations. This relationship indeed holds true, when GDP/capita is plotted against total energy consumption/capita in energy unit for national economies.
- Electricity, which is commonly referred to as power, is the rate of flow of electrical charges under a potential difference. Basically, when chemical energy in fuels or electromagnetic radiation of the sun or energy of the atom or kinetic energy of the wind or potential energy of water etc are expended and transformed into, and interacted with, other forms of energy; flow of electrical charges can be induced. Electricity is therefore a derived energy form from other energy sources.

1. Introduction Cont'd….

- Nigeria is endowed with fossil, renewable and nuclear sources of energy as shown in Tables 1 and 2. It has 36.2 billion barrels or crude oil reserves, 187 TSCF of natural gas reserves, 2.7 billion tons of coal reserved, 31 billion barrels of oil equivalent of tar Sands. The country also has about 15MW of hydropower potential, solar intensities of 3.5 kWh/m^2 /day – 7.5 kWh/m^2/day and an average sunshine of 6hrs/day, wind speeds of about 2-4 hrs/day at 10m height, as well as generates about 43 million tonnes of municipal waste annually, mainly organic. Large arable land for production of energy crops and other biomass is also available. With all these resources, however, grid-power supply estimated at 176 KWh/capita in 2012 in Nigeria has been low and forms one of the weak links towards our achieving greatness and to be one of the 20 large economies in the World by 2020 or thereabout. Meeting this challenge requires an integrated strategic planning to tackle the energy trilemma of energy security, affordability and social responsibility (environmental consequences).

1. Introduction Cont'd….

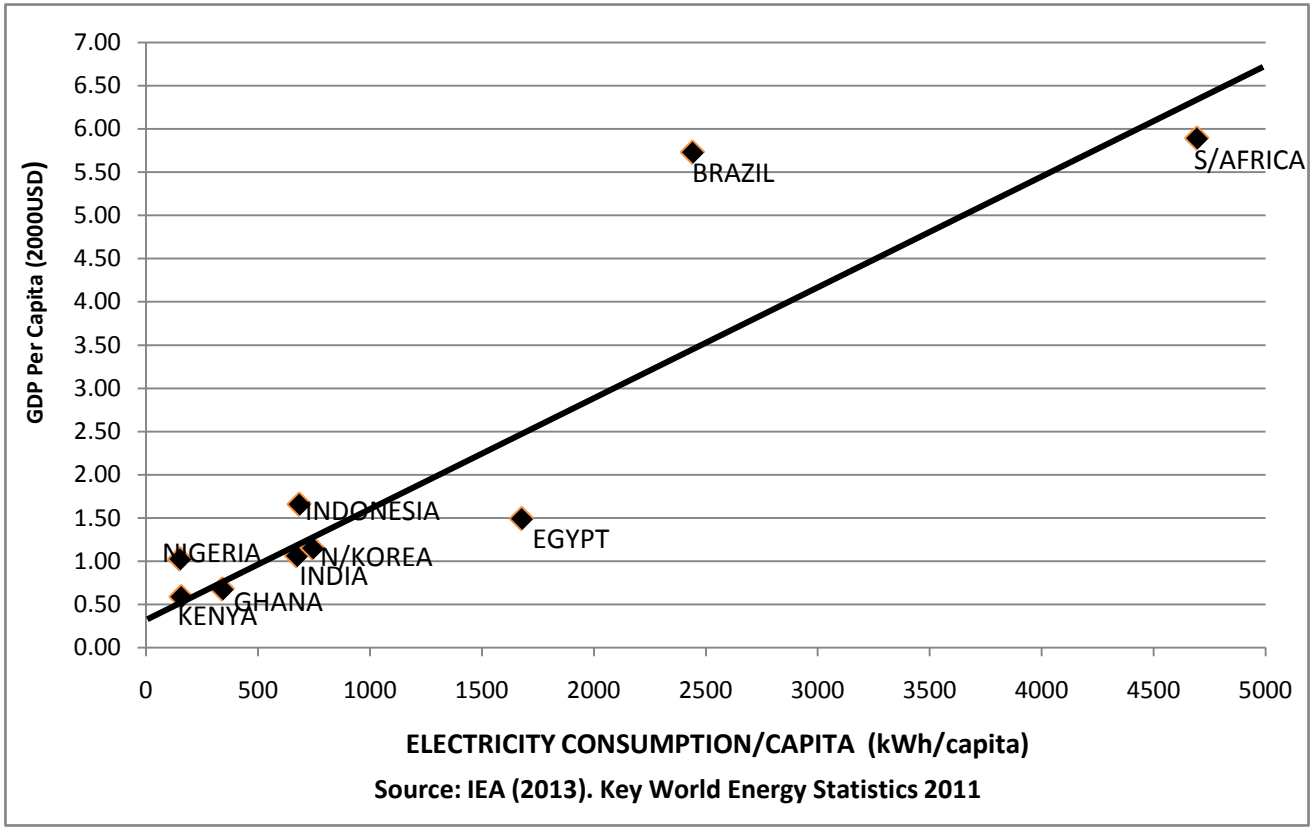

Figure 1 Effect of Electrical Energy Consumption on Economic Development of Nations.

1. Introduction Cont'd….

Table 1 Fossil Energy Resources and Nuclear Energy Sources

S/N	Resources	Reserves	Production (2012)	Domestic Utilization (2012)
1	Crude Oil	37.2billion barrels	0.853billion barrels	0.164billion barrels
2	Natural Gas	187 Tscf	2.58Tscf	77% : Utilized 23% : flared
3	Coal	2.7 billion tonnes	0	Negligible
4	Tar Sands	31 billion barrels of oil equivalent	0	18.25 million barrels
5	Nuclear	Yet to be quantified	0	30kW experimental nuclear reactor

Source: NNPC/ECN

1. Introduction Cont'd….

Table 2 Renewable Energy Resources

S/N	Resource		Reserve	Utilization Level
1	Large hydro power		11,250MW	1,900MW
2	Small Hydro power		3,500MW	64.2MW
3	Solar Energy		4.0 kWh/m^2/day 6.5kWh/m^2/day	15MW solar PV stand-alone No solar thermal electricity
4	Wind		2-4m/s at 10m height	2x2.5KW electricity generator; 10MW wind farm in Katsina
5	Biomass	Fuel wood	11 million hectares of forest and woodlands	43.4 million tonnes of firewood/yr
		Municipal waste	- 18.3 million tonnes in 2005* & about 30 million tonnes/yr now	-
		Animal waste	- 243 million assorted animals in 2001	-
		Energy Crops and agric waste	- 72 million hectares of Agricultural land	28.2 million hectares of Arable land

Source: Renewable Energy Master Plan (REMP)

1. Introduction Cont'd….

Table 3. Nigeria's Energy Supply and The Economy

S/N	ITEMS	200	2004 3	2005	2006	2007	2008	2009	2010	2011	2012
1.	Electricity generation (billion kWh)	22.0	23.9 3	24.22 (503)* (10,695)**	23.8	23.3	21.27 (562)* (18,603)**	20.8	25.02	27.7 (619)* (20,407)**	29.6
2,	Energy Consumption per Capita (kgoe/Capita)	151.	125.5 3	132.6 (680)* (1,780)**	87.1	81.4	80.8 (670)* (1,830)**	83.1	77.8	73.6 (670)* (1880)**	65.7
3.	Electricity Consumption/capita (kWh/Capita)	174.	176.4 6	181.4 (563)* (2596)**	167.6	161.2	142.9 (571)* (2782)**	135.2	157.1	165 (592)* (2933)**	175.9
4.	GDP/Capita (US$/Capita)	620.	658.0 7	826.3 (2314)* (8,492)**	1030.3	1223.5	1286.3 (2540)* (9550)**	1,106.8	1440.7	1470.6 (1281)* (7520)**	1513.4
5.	Energy Intensity (kgoe/ US$)	0.24	0,191 4	0.161 (0.294)* (0.210)**	0.085	0.067	0.063 (0.264)* (0.192)**	0.075	0.054	0.050 (0.550)* (0.250)**	0.043
6.	GDP Growth Rate (%)	9.6	6.6	6.5	6.0	6.5	6.0	7.0	8.0	7.4	6.6

Sources: CBN (2005-2012), NCC, Osogbo (2009 -2012),
****Africa Average - IEA (2007, 2010, 2013)***
*****World Average - IEA (2007,2010, 2013)***

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1. Introduction Cont'd….

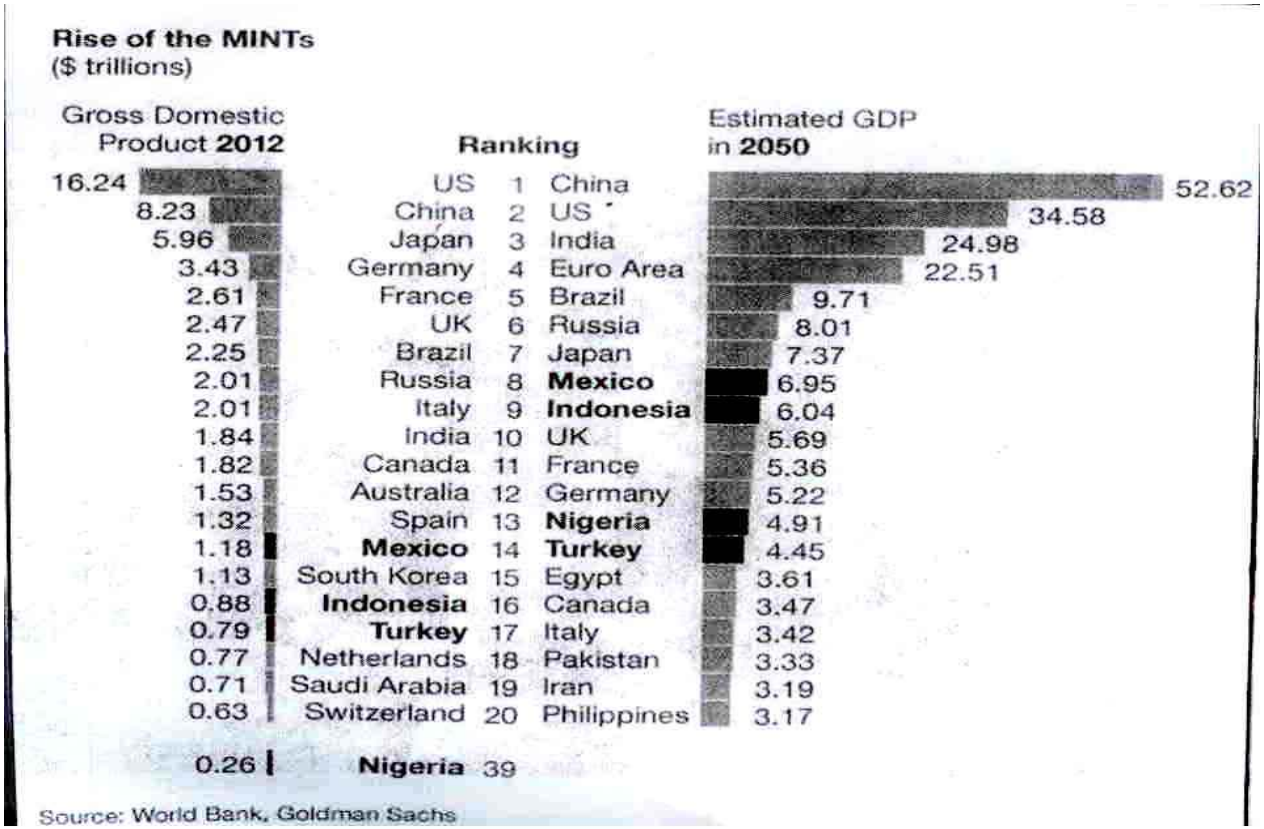


Figure 2. Nigeria's Ranking in the World based on GDP

2. Where are we and from where?

- The Nigerian energy scene began, when in 1914, the Northern and Southern protectorates under the Colonial British Government were amalgamated to form the present state of Nigeria situated between latitudes 4^{o} N and 14^{o} N and longitudes 3^{o} E and 14^{o} E

a) Petroleum (Oil and Gas)

– In 1914, the Minerals Oils ordinance of Nigeria was made by the Colonial Government, which ensured that all minerals oil under Nigeria soil a legal property of the Crown. Licenses for oil production were restricted to British Companies and individuals. In 1938, Shell D'Arcy company, a company jointly owned by Shell and British Petroleum (BP) was given exclusive exploration and production regions in Nigeria. In 1955 Shell D'Arcy's monopoly was reduced and concession area was granted to Mobil, an American Oil Company.

2. Where are we and from where? Cont'd…

- In 1956, and in Olaibiri, about 90km west of Port Harcourt and now present Bayelsa State, crude oil in commercial quantity was first found in Nigeria by Shell D'ARCY. The first export of crude oil was in 1958 with export of 5,100 barrels per day (BPD). The 1959 Petroleum profit tax legislation made sharing of proceeds from oil on a 50:50 basis between the host country and foreign oil companies.
- It may be recalled that Nigeria got independence in 1960, the same year Organization of Petroleum Exporting Countries (OPEC) was found in Badhdag, Iraq. OPEC's objective was to check concessioners from lowering prices, which they always specified or posted and to take control of their oil resources.
- By 1961 oil production stood at 46,000 bpd, while natural gas produced was about 11,500 standard cubic feet (SCF) per year.
- By 1962, Shell's arena of concession was further reduced to more promising areas, while more actors like Elf, Agip etc came into the scene in line with the 1962 Mineral Oils Act, which repealed the provision of the 1914 Act reserving concessions for oil exploration to only British subjects.

2. Where are we and from where? Cont'd…

- In 1964, Nigeria attended the first OPEC meeting as an observer. In 1965, the Bonny Island Export facility terminal was completed; and oil and natural gas production was about 272,000 bpd and 105,500 SCF/year, respectively. In the same year, the Oil Pipelines Act of 1965 and the regulations made there under as well as the Hydro Carbon Refineries Act and the regulations there under were made. These enabled the establishment of the first refinery in Nigeria built at Alesa Eleme, Port Harcourt with a name plate capacity of 35,000 bpd, considered then sufficient to meet domestic needs. It was build and operated by Shell. The population of Nigeria was then about 58.7 million. This was later acquired by Government (NNPC). It may be noted that hitherto all Petroleum products consumed in the economy were all imported, and by the international oil companies (IOCs).
- In 1966, the first coup d'etat occurred, which plunged the country into a civil war that lasted up to 1970. Within this period crude oil production dropped from 418,000 bpd in 1966, to 142,000 bpd in 1968; and then rose to 1,084,500bpd in 1970.

2. Where are we and from where? Cont'd…

- In 1968, the Nigerian Company Decree compelled all companies operating in Nigeria to incorporate Nigerian entities; while the 1969 Petroleum decree and the Petroleum (Drilling and Production) regulation provided a comprehensive framework for administering the activities of the oil companies. These decrees provided Nigeria legal framework for participation in the oil companies, which commenced with 35% and later grew to 50%.
- It may be noted that Petroleum matters had been handled by the Hydrocarbon section of the Ministry of Lagos Affairs in the earlier fifties. It was the first statutory agency set up to supervise and regulate the Petroleum industry in Nigeria, which reported to the Governor General. The section was upgraded to Petroleum Division within the then Ministry of Mines and Power. The division, in 1970, became the Department of Petroleum Resources (DPR).
- In 1971, Nigeria joined OPEC, and in the same year the Nigerian National Oil Corporation (NNOC) was created to engage in commercial activities in an attempt to realize the indigenization of the oil industry in response to call by OPEC for member states to participate actively in their oil industry, while DPR continued to perform the supervisory and control duties in the oil industry. This direct participation by NNOC was done through joint ventures (JVS). In 1974, Nigeria's participation in the oil companies had reached 55%.

2. Where are we and from where? Cont'd…

- The DPR was in 1975 constituted into the Ministry of Petroleum Resources. In the same year 1975, the PPT reached 85% and remained there since.
- In 1977, the MPR and NNOC were merged to form the Nigerian National Petroleum Corporation (NNPC), in a bid to optimize the utilization of the then scarce indigenous manpower in the public sector of the oil industry. The same instrument that created NNPC also established the Petroleum Inspectorate, which served as the regulator of the industry, which however, reported to the Minister of Petroleum. In 1978, Government began to build local refineries and distribution networks.
- In 1979 Nigeria participation in upstream oil companies had reached 60%.
- In 1985, a new Ministry of Petroleum Resources was again created, while the Petroleum Inspectorate remained in NNPC and as the regulator of the industry.
- With the commercialization of NNPC in 1988 into twelve (12) strategic business units covering the entire spectrum of oil industry operations of exploration and production, gas development, refining, distribution, petrochemicals, engineering and commercial investments; the petroleum inspectorate was excised and merged with Ministry of Petroleum Resources but maintained its regulatory functions.

2. Where are we and from where? Cont'd…

- By 1989, four (4) government owned and managed oil refineries with a total installed capacity of 445,000 bpd were installed, to meet domestic needs, when population was about 83.8 million. However, Since 1989 to date no new refinery has been added to meet the growing demand in Petroleum Product for automobile fuel, power generation, heating fuel, lubricants etc for a population of about 170 million now and growing at 3.2% annually. Secondly, the capacity utilization of these refineries have been dropping to unacceptable levels. For instance, the combined average refining capacity utilization for year 2012 was 21%. This has led to massive importation of products to meet domestic needs.
- Also, in 1989 the Nigeria Lignified Natural Gas (NLNG) with Government take was incorporated; and ten (10) years later, NLNG commenced production for exports.

2. Where are we and from where? Cont'd…

Table 4. Historical Evolution of Refineries in Nigeria with their Installed Capacity

Refinery	Year Commissioned	Capacity (Barrels/Day)								
		1965	**1971**	**1978**	**1980**	**1987**	**1988**	**1989**	**1998**	**2014**
P/H Refinery I	1965	35,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000	60,000
P/H Refinery II	1989	-	-	-	-		-	150,000	150,000	150,000
Warri Refinery	1978	-	-	100,000	100,000	125,000	125,000	125,000	125,000	125,000
Kaduna Refinery	1980	-	-	-	110,000	110,000	110,000	110,000	110,000	110,000
Total		35,000	60,000	160,000	270,000	295,000	295,000	445,000	445,000	445,000

Source: NNPC

2. Where are we and from where? Cont'd…

- The challenges and inefficiencies in the operation of the joint ventures and the unsatisfactorily performance of the downstream public enterprises as well as complexity on the management of the NNPC, coupled with too many laws in the oil and gas industry necessitated calls for structural reforms in the Nigeria Petroleum industry to position it for greater benefits to the Nation in line with international best practices.
- Thus in 2000, Government incorporated the Oil and Gas sector Reform Implementation Committee (OGIC) to carry out far reaching reforms in the Petroleum industry. To involve new National Oil and Gas Policy, which will ensure separation and clarity of roles, infuse strict commercial orientation in all relevant sections of the industry.

2. Where are we and from where? Cont'd…

- In 2003, the Petroleum Product Pricing and Regulation Agency (PPPRA) was established to regulate the downstream oil sector.
- In 2006, MPR and Ministry of Power were merged to form the Ministry of Energy. A year later, the Ministry of Energy was reverted back into MPR and Ministry of Power and remains so to this day, with DPR still under the MPR.
- In 2007, the Government inaugurated another 2nd OGIC committee to work on the National Oil and Gas policy produced by the 1st Committee with the view to bringing out new institutional framework for the industry. This produced Lukman Report of 2008, which went through another review before it was forwarded in 2012 to the National Assembly as the popular Petroleum Industry Bill (PIB).
- In 2010, the Nigerian Oil and Gas Industry Content Development Act was made with the Primary objective of enhancing the level of participation of Nigerians and Nigerian Companies in the country's Petroleum Industry.

2. Where are we and from where? Cont'd…

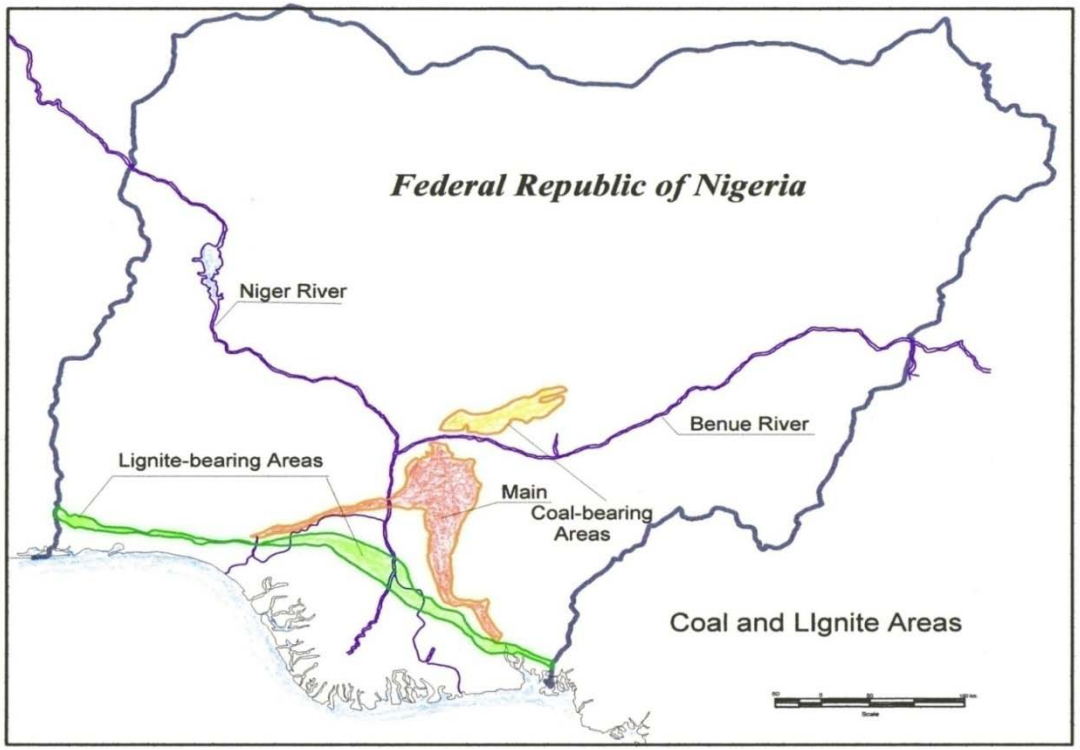
b) Coal/Lignite, Tar Sands/Bitumen and Uranium

i. Coal/Lignite:

– Organized mining began in 1903 when the Mineral Survey of the Northern protectorates was created by the British Colonial Government. A year later, the mineral survey of the Southern protectorate was founded. Coal was first discovered in Enugu in 1909. Its production began as early as 1916, with an annual production output of 24,511 tonnes. In 1950, the Nigerian Coal Corporation (NCC) was established by Government and charged with the responsibility of exploring, developing and exploiting the country's coal and lignite resources. The production peaked in 1959 with an output of 905,397 tonnes per annum. Production of coal seized during the 1966-1970 civil hostilities. After the hostilities, production peaked again, in 1972, at 323,001 tonnes per annum; there after, it began to decline. Between 1988 and 1998, coal production generally continued to decline from an output of 82,490 tonnes to 21,940 tonnes per annum.

2. Where are we and from where? Cont'd…

– The decline, in the 1970s in coal production was mainly due to the loss of its traditional market to newly found and more competitive fuel substitutes, e.g. diesel for locomotive engines and high pour fuel oil (HPFO) and natural gas for power generation. The contribution of coal in the nation's energy mix declined from 70% in the 60s to insignificant value now. Figure 2 shows locations of coal and lignite deposits in Nigeria



(MODIFIED AFTER BEHRE DOLBEAR, 2005)
Source: Nigerian Coal Corporation (2009)

Figure 3 Coal & Lignite Deposits of Nigeria

2. Where are we and from where? Cont'd…

ii. Tar Sands/Bitumen

- Focused exploration of Bitumen began in 1905. Tar Sands deposits are found in Osun, Ondo and Edo States axis. Tar sands production is yet to commence.

iii. Nuclear Energy

- The Nigeria Uranium Mining Company (NUMCO) was established as a public private partnership with Total Compagnie Miniere of France for the exploration and mining of uranium in Nigeria. In 1989 Total pulled out and in 1993, government transferred Numco's responsibilities to the Nigerian Geological Survey. Some studies have found traces of nuclear minerals in Cross Rivers state, North-West and North-East of the country.
- Nuclear implementation and regulatory institutions, Nigeria Atomic Energy Commission (NAEC) and Nuclear Regulatory Authority (NNRA) were established in 1976 and 1995 through their enabling Acts, respectively. However, NNRA commenced operation in 2001 while NAEC commenced operation in 2006.

2. Where are we and from where? Cont'd…

– The Nuclear Energy Research & Training Centres in Zaria and Ile-Ife were established by the NAEC Act of 1976 and started operations in 1979

c) Renewables

– Renewable Energy sources such as Solar, Wind and Biomass have been used as traditional rather than commercial energy sources until of recent. Hydropower, a renewable energy source, however, has been utilized since 1929 by NESCO in Bukuru, Jos for Electricity generation. About 200 MW of hydropower has been installed mainly in Niger state. New installations of about 3,300 MW capacity are on the way at Zungeru and Mambilla. Figure 3 shows solar radiation resources distribution in Nigeria

2. Where are we and from where? Cont'd…

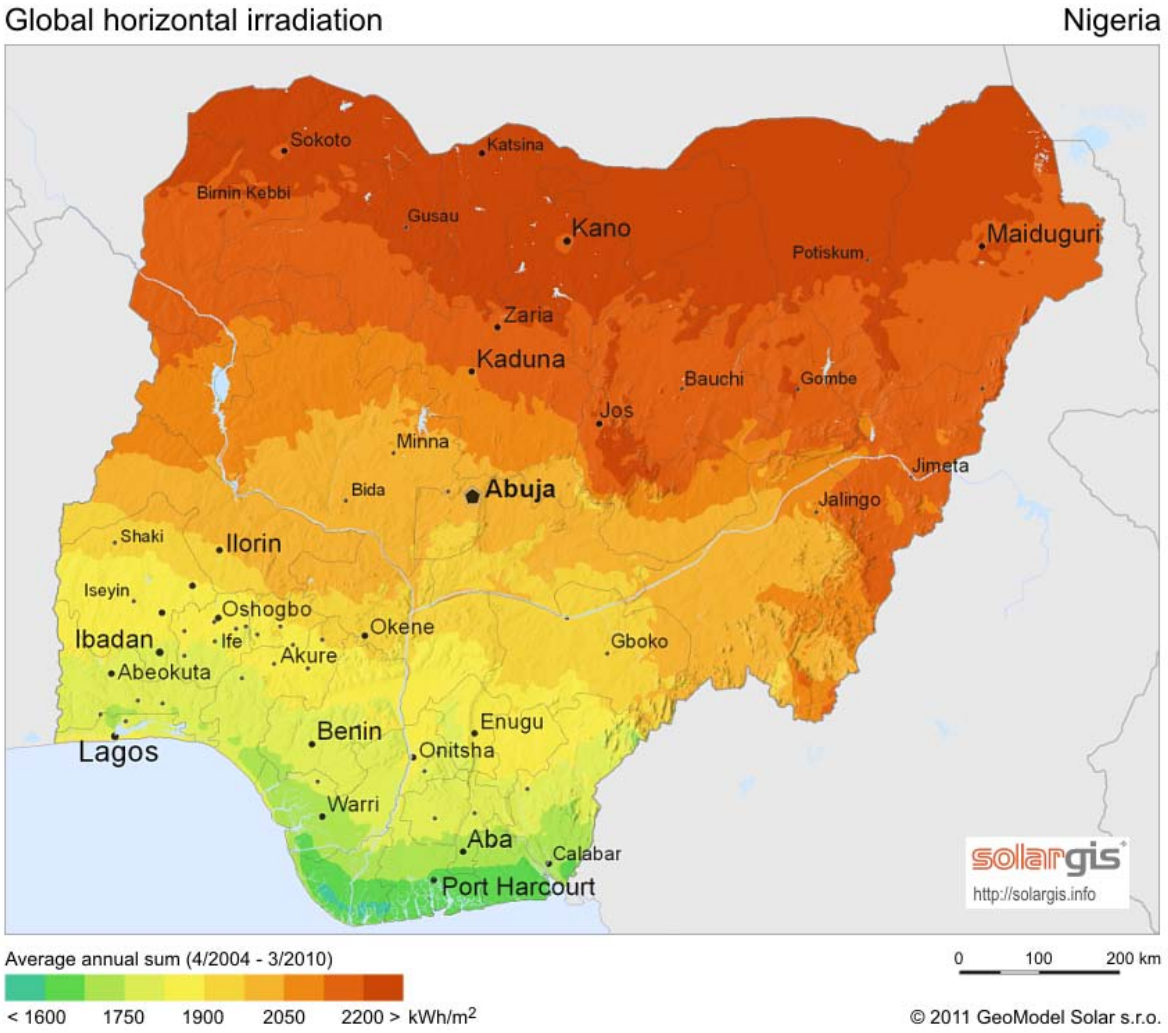


Figure 4. Solar Map GIS

2. Where are we and from where? Cont'd…

d) Electricity/Power

- 1914 – 1960 (Colonial Era)
  - Public Works Department (PWD) of the Colonial Administration commenced operating electricity industry in Nigeria since 1896 with 60kW diesel generators;
  - In 1951, the Electricity Corporation of Nigeria (ECN) was established to take over from PWD & continued to supplied Administrative centres and industrial areas ;
  - About 50MW was put in place by 1960 mainly distributed generation using diesel fuel.
- 1960 - 1990 (Democratic Parliamentary System & Military rules)
  - About 67% of this period was under Military rule;
  - While ECN continued to expand, Niger Dam Authority (NDA) was established in 1962 to cater for hydropower development;
  - ECN and NDA were merged in 1972 to form National Electric Power Authority (NEPA), a vertically integrated electricity company;
  - The electricity industry grew from about 50MW in 1960 to about 6000MW in 1990 with an average capacity growth rate of about 200MW/year

2. Where are we and from where? Cont'd…

Table 5. Government Own Power Stations before Reforms

S/N	Plant	Year Commissioned	Fuel Type	Installed Capacity (MW)
1	Kainji	1968	Hydro	760
2	Jebba	1986	Hydro	578
3	Shiroro	1990	Hydro	600
4	Egbin	1985	Thermal Steam/NG, HPFO	1320
5	Sapele I	1978	Thermal Gas Turbine/NG	720
6	Sapele II	1981	Thermal Gas Turbine/NG	300
7	Ijora	1978	Thermal Gas Turbine/NG	60
8	Delta	1975	Thermal Gas Turbine/NG	912
9	Afam	1963	Thermal Gas Turbine/NG	711
10	Oji	1956	Coal	30
Total				**5991**

Source: ECN

2. Where are we and from where? Cont'd…

d) Electricity/Power

- 1990 – 1999 (Military)
  - Industry still managed by NEPA
  - National population grew and demand for electricity continued to grow
  - No new power plant was added to the grid within this period and there was decline in performance
  - By the end of this period available power was below 2000MW
- 1999 – 2007 (Democracy under Presidential System)
  - Private sector driven economic policy initiated in 1999
  - In 2001, private sector driven electric power policy evolved
  - In 2005, the Electric Power Sector Reform Act was enacted that deregulated and liberalized the electricity industry in the country
  - With the ACT, NEPA was reformed into Power Holding Company of Nigeria (PHCN), which was unbundled into 18 sisters companies; 6 generation companies, 1 transmission company and 11 distribution companies in preparation for privatization.
  - Nigerian Electricity Regulatory Commission (NERC), regulator of the industry was established. Also, the Rural Electrification Agency (REA) was established

2. Where are we and from where? Cont'd…

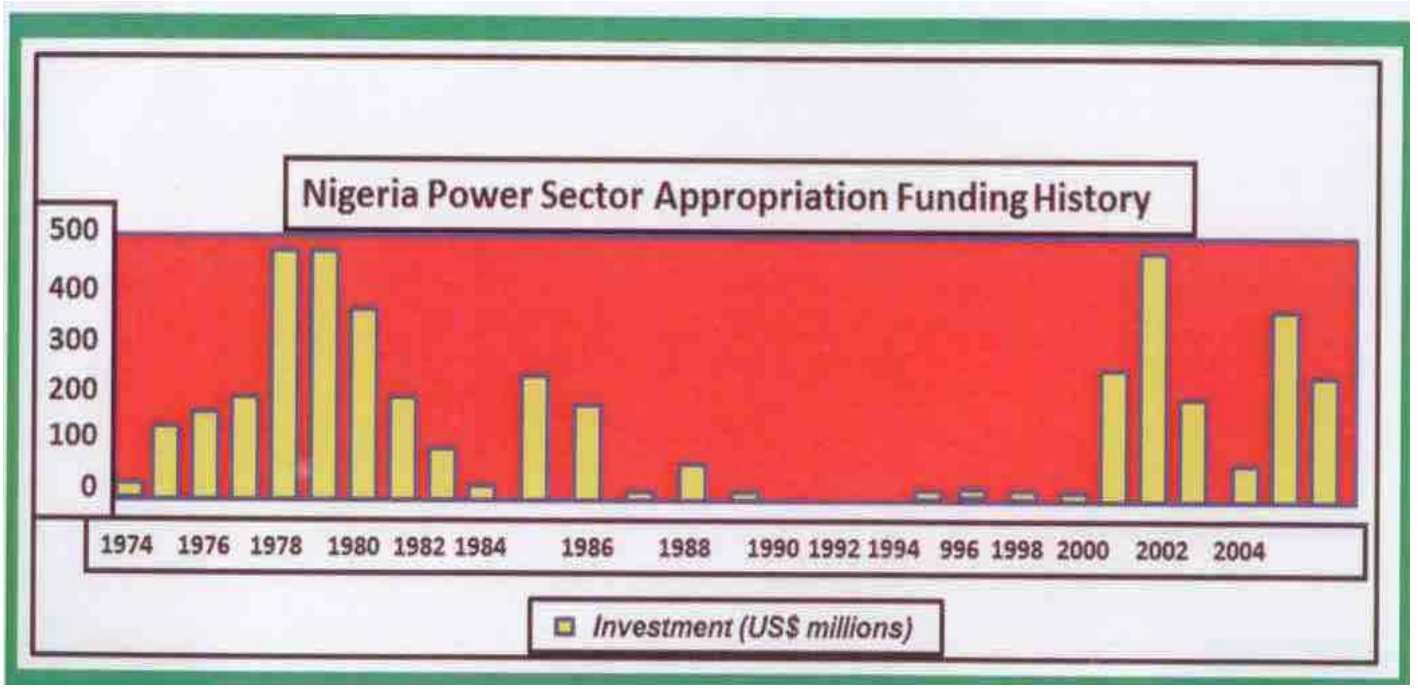


Figure 5. Power Sector Appropriation (1974 – 2007)

Source: FMP, 2014

2. Where are we and from where? Cont'd…

- In order to fast tract increase in generation, transmission and distribution capacities, government initiated the National Integrated Power project (NIPP) in 2005;
- By the end of this period, installed grid generation capacity was raised to 7777.4MW with an average availability of 4156.19MW

– 2007 – 2010 (Democracy under Presidential System)

- Power reforms implementation was sluggish within this period
- Cost reflective electricity tariff referred to as the Multi Year Tariff Order (MYTO) was established by NERC
- PHCN was the major driver of the electricity industry
- At the end of this period, grid generation capacity increased to 8425.4MW with average availability of 4212.7MW

– 2010 – Date (Democracy under Presidential System)

- Power reforms got pursued with vigour within this period
- Road Map for power sector reform was established in 2010
- The Nigerian Bulk Electricity Company referred to as the bulk trader was established as a transition instrument to go into power purchase agreement

2. Where are we and from where? Cont'd…

- The Nigerian Electricity Liability Management Company (NEMCO) was also established to assume and manage extant assets, liabilities, and other obligations that could not be easily transferred from PHCN to any of the successor companies
- Feed-in Tariff (FiT) for renewables established by NERC to facilitate penetration of electricity from renewables
- By end of 2012, grid connected generation capacity was 9955.4MW with an average availability of 5516.38MW
- By end of 2013, all the 18 PHCN companies were successfully and transparently transferred to core investors, while the Transmission company was given to a Management Contractor;
- The generation plants of the NIPPs (10 No) are also being privatized through due process to core investors. Financial bids for the 10 power plant was opened on March 7th, 2014.

2. Where are we and from where? Cont'd…

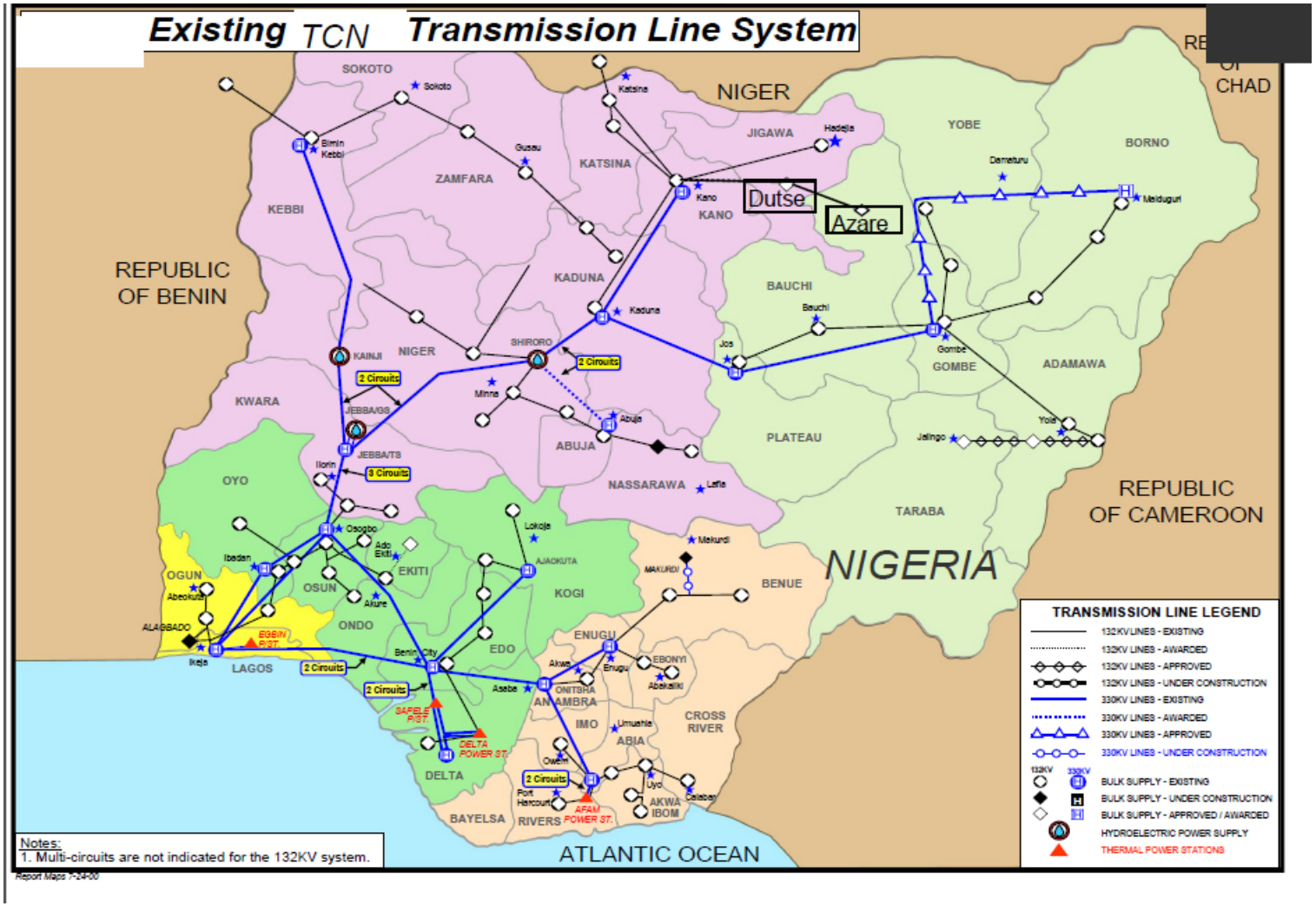


Figure 6. Transmission Lines System in Nigeria

2. Where are we and from where? Cont'd…

Table 6. Grid Connected Power Plants 2010

SUMMARY OF GENERATION CAPABILITIES OF PHCN POWER STATIONS AS OPERATED IN THE YEAR 2010(JANUARY - DECEMBER)

POWER STATION	AVAILABILITY FACTOR (MW)	AVERAGE AVAILABILITY (MW)	INSTALLED CAPACITY (MW)
KAINJI HYDRO	0.54	412.55	760.00
JEBBA HYDRO	0.75	431.83	578.40
SHIRORO	0.65	390.21	600.00
EGBIN STEAM	0.62	819.55	1320.00
AJAOKUTA	0.00	0.00	110.00
A.E.S (GAS)	0.69	208.20	302.00
SAPELE ST	0.17	125.17	720.00
OKPAI GAS/	0.92	441.57	480.00
AFAM (I-V) (GAS)	0.04	21.56	516.00
AFAM VI (GAS)	0.67	435.64	650.00
DELTA (GAS)	0.38	342.95	900.00
GEREGU (GAS)	0.50	208.69	414.00
OMOKU GT	0.53	80.18	150.00
OMOTOSHO	0.36	118.93	335.00
TRANS-AMADI	0.33	32.63	100.00
IBOM	0.53	82.89	155.00
OLORUNSOGO	0.18	60.13	335.00
TOTAL	0.50	4212.70	8425.40

Source: National Control Centre, Osogbo (2010), Annual technical report

2. Where are we and from where? Cont'd…

Table 7. Grid Connected Power Plants 2012

SUMMARY OF GENERATION CAPABILITIES OF PHCN POWER STATIONS AS OPERATED IN THE YEAR 2012(JANUARY - DECEMBER)			
POWER STATION	**AVAILABILITY FACTOR (MW)**	**AVERAGE AVAILABILITY (MW)**	**INSTALLED CAPACITY (LESS DE-COMMISSIONED UNITS) MW**
PHCN - HYDRO STATIONS			
KAINJI HYDRO	0.39	295.38	760.00
JEBBA HYDRO	0.72	414.42	578.40
SHIRORO	0.83	497.46	600.00
SUB TOTAL	0.62	1207.26	1938.40
PHCN - THERMAL STATIONS			
EGBIN STEAM	0.77	1022.56	1320.00
AFAM (I-V) (GAS)	0.27	95.32	351.00
DELTA (GAS)	0.27	246.23	900.00
SAPELE ST	0.14	98.52	720.00
GEREGU (GAS)	0.66	274.96	414.00
OLORUNSOGO I	0.64	214.39	335.00
OMOTOSHO	0.34	113.02	335.00
SUB TOTAL	0.47	2064.99	4375.00
NIPP - THERMAL STATIONS			
OLORUNSOGO II	0.66	496.20	750.00
OMOTOSHO NIPP	0.29	144.73	500.00
SAPELE NIPP	0.58	218.26	375.00
SUB TOTAL	0.53	859.20	1625.00
IPP - THERMAL STATIONS			
RIVERS IPP	0.20	35.12	180.00
OMOKU GT	0.26	38.53	150.00
TRANS-AMADI GT	0.31	30.65	100.00
OKPAI GAS	0.92	440.86	480.00
IBOM	0.21	32.08	155.00
AFAM VI (GAS)	0.93	603.70	650.00
A.E.S (GAS)	0.68	203.99	302.00
SUB TOTAL	0.69	1384.93	2017.00
GRAND TOTAL	**0.55**	**5516.38**	**9955.40**

Source: National Control Centre, Osogbo (2012), Annual technical report

2. Where are we and from where? Cont'd…

Table 8. PHCN Successor Distribution Companies and their Core Investors

S/N	DISTRIBUTION COMPANY	STATES COVERED	CORE INVESTOR
1	Port Harcourt Electricity Distribution Company	Bayelsa, A/Ibom, C/River, Rivers	4Power Consortium
2	Abuja Electricity Distribution Company	FCT, Nasarawa, Niger, Kogi	KANN Utility Consortium Nig. Ltd
3	Benin Electricity Distribution Company	Ekiti, Edo, Ondo, Delta	VIGEO Power Consortium
4	Ikeja Electricity Distribution Company	Alimosho, Ikeja, Ikorodu	KEPCO Consortium
5	Enugu Electricity Distribution Company	Abia, Ebonyi, Anambra, Enugu, Imo	InterState Electrics Ltd
6	Ibadan Electricity Distribution Company	Ogun, Oyo	Integrated Energy Distribution Making Company
7	Jos Electricity Distribution Company	Bauchi, Gombe, Plateau, Benue	Aura Energy Limited
8	Kaduna Electricity Distribution Company	Kaduna, Zamfara, Sokoto	Yet to be sold
9	Kano Electricity Distribution Company	Kano, Katsina, Jigawa	Sahelian Power SPV Ltd
10	Eko Electricity Distribution Company	Festac, Ijora, Lagos Island, Ajah, Agbara/ Badagry District	West Power and Gas Ltd
11	Yola Electricity Distribution Company	Yobe, Taraba, Bornu, Adamawa	Integrated Energy Distribution & Marketing Ltd

2. Where are we and from where? Cont'd…

Table 9. PHCN Successor Generating Companies & Core Investors

S/N	Name	Capacity (MW)	Core Investor
1	Afam Power Plc	987.2	Not yet finalized
2	Egbin Power Plc	1,320	Not yet finalized
3	Kainji Hydro Electric Plc	760	Mainstream Energy Solutions Ltd.
4	Sapele Power Plc	1,020	CMEC/EURAFRIC Energy Ltd.
5	Shiroro Hydro Electric Plc	600	North-South power Company
6	Ughelli Power Plc	942	Transcorp Ughelli Power PLC
Total		**5,629.2**	

2. Where are we and from where? Cont'd…

Table 10. NIPP Generating Companies & Core Investors

S/No	Name	Location	Capacity (MW)	Core Investor
1	Alaoji Generating Company Ltd	Aba, Abia State	831.3	Yet to be sold
2	Benin Generating Company Ltd	Benin City, Edo State	507.6	Yet to be sold
3	Calabar Generating Company Ltd	Calabar, Cross River State	634.5	Yet to be sold
4	Egbema Generating Company Ltd	Owerri, Imo State	380.7	Yet to be sold
5	Gbarani Generating Company Ltd	Yanegoa, Bayelsa State	253.8	Yet to be sold
6	Geregu Generating Company Ltd	Ajaokuta, Kogi State	506.1	Yet to be sold
7	Ogorode Generating Company Ltd	Sapele, Delta State	507.7	Yet to be sold
8	Olorunsogo Generating Company Ltd	Olorunsogo, Ogun State	754.0	Yet to be sold
9	Omoku Generating Company Ltd	Port Harcourt, River State	264.7	Yet to be sold
10	Omotosho Generating Company Ltd	Okiti Pupa, Ondo State	512.82	Yet to be sold
	Total		5,153.12	

2. Where are we and from where? Cont'd…

Table 11. Independent Power Plants (IPPs)

S/ No	Name	Capacity	Location	Remarks
1	AES, lagos	300MW	Lagos State	grid connected
2	AGIP, Okpai	480MW	Delta State	grid connected
3	Obajana	350MW	Kogi State	self generation
4	Akute, lagos	12.5MW	Lagos State	self generation
5	Island, Lagos	10MW	Lagos State	self generation
6	Alausa, Lagos	10MW	Lagos State	self generation
7	Ibom Power	188MW	Akwa Ibom State	grid connected
Total		**1,350.5MW**		

2. Where are we and from where? Cont'd…

Table 12. New FGN Power Plants

S/No	Name	Capacity	Location	Remarks
1	Zungeru Hydro	700MW	Niger State	On-going
2	Gurara I Hydro	30MW	Kaduna State	Completed
3	Gurara II Hydro	300MW	Niger State	Under Study
4	Kalamkasi hydro	40MW	Taraba State	On-going
5	Kaduna Thermal Power	200MW	Kaduna State	On-going
6	Mambila Hydro	2,600MW	Taraba State	Under study
7	Tunga Dam	400kW	Taraba State	On-going (UNIDO)
8	Waya Dam	150kW	Bauchi State	Completed (UNIDO)
9	Ezioha-Mgbowo	30kW	Enugu State	Completed(UNIDO)
Total		**3,870MW**		

2. Where are we and from where? Cont'd…

e) Current Institutional Framework in the Energy Sector

– Figure 4 shows stakeholders Ministries, Department and Agencies in Nigeria.

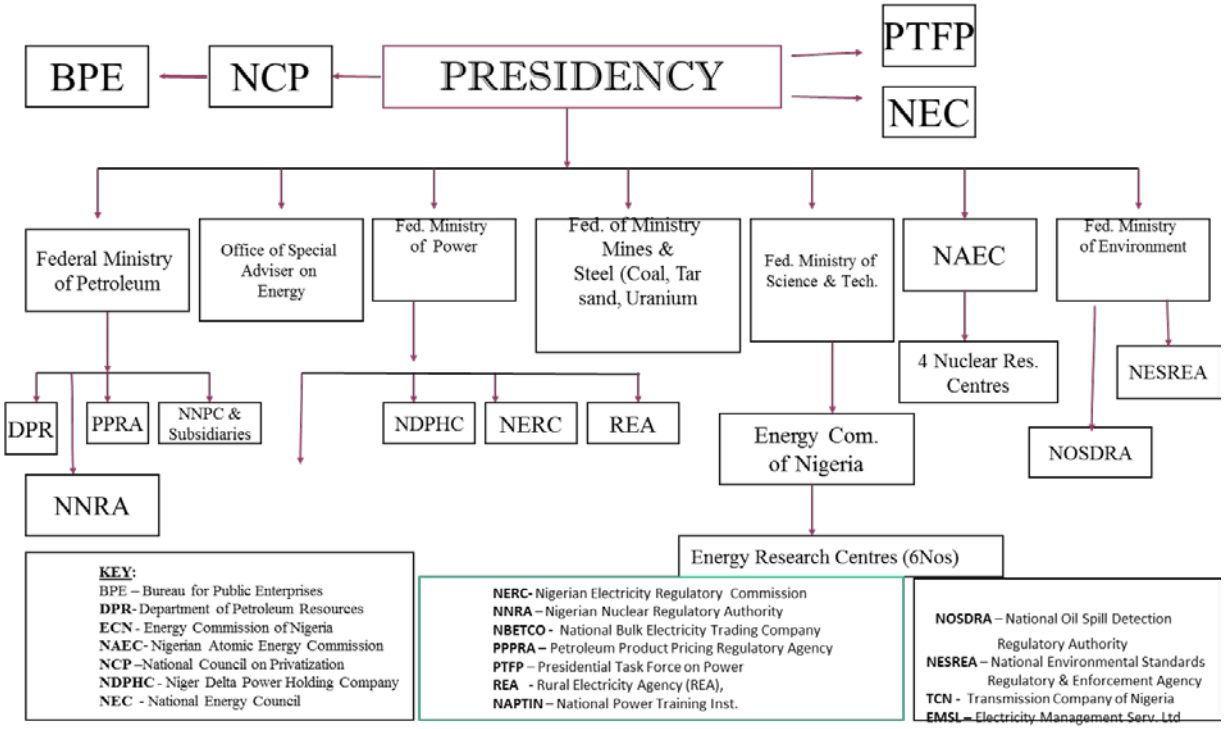


Figure 7. Institutional Framework in the Energy Sector in Nigeria as at 2014.

2. Where are we and from where? Cont'd…

- The Energy Commission of Nigeria, which I head, was established in 1979 by law. It however commenced operation in 1989 after the meeting of the Heads of ECOWAS on 29th May 1982 in Cotonou, where a decision was taken that each member state should establish by law, a body within the machinery of government, to be charged with the responsibility for coordinating and supervising all energy functions and activities within each Member State and may be called ENERGY COMMISSION of each Member State.
- The primary legal mandate of the ECN is to produce strategic plans and co-ordinate national policies on energy in all its ramifications.

3. Where Do We Want to Be

- The Nation's vision is to be amongst the 20 large economies in the world by 2020. Nigeria was number 39 in 2012. However with the rebasing in 2013, we jumped to number 26. This upwards movement requires adequate, reliable and cost effective supply of electricity, fuels and process heat in the economy.
- This however must be done in a responsible and sustainable manner i.e the energy trilemma must be faced squarely.
- A study conducted by Energy Commission of Nigeria on Nigeria's long term energy demand and supply using IAEA energy planning tools of MAED and MESSAGE predicted huge amount of energy requirements under the following scenarios and assumptions:

3. Where Do We Want to Be

The assumptions for the study are as follows:

Reference Growth Scenario:

- GDP grows by an average of 7% per annum.
- The main driver of growth is the manufacturing sector
- Manufacturing to account for 15% of GDP by 2020 from 4% in 2010
- Poverty to be reduced by half by 2015 in line with MDG objectives.

High Growth Scenario

- GDP grows by an average of 10% p.a.
- Manufacturing to contribute 22% to GDP by 2030 from 4% in 2010
- Nigeria transits from an agrarian to an industrializing economy

3. Where Do We Want to Be

- **Optimistic Growth Scenario I**
  - GDP grows by an average of 11.5% p.a.
  - Manufacturing to contribute 22% to GDP by 2030 from 4% in 2010
  - Nigeria transits from an agrarian to an industrializing economy

- **Optimistic Growth Scenario II**
  - GDP grows by an average of 13% p.a.
  - Manufacturing to contribute 22% to GDP by 2030 from 4% in 2010
  - Nigeria transits from an agrarian to an industrialized economy

3. Where Do We Want to Be Cont'd….

Table 13. Projected Electricity access for old and new dwellings

Scenarios / Year (%)	2009	2010	2015	2020	2025	2030
Ref (7%)	52	60	65	75	80	85
High (10%)	52	70	72	86	93	95
Opt I (11.5%)	52	70	72	86	93	95
Opt II (13%)	52	75	80	86	93	95

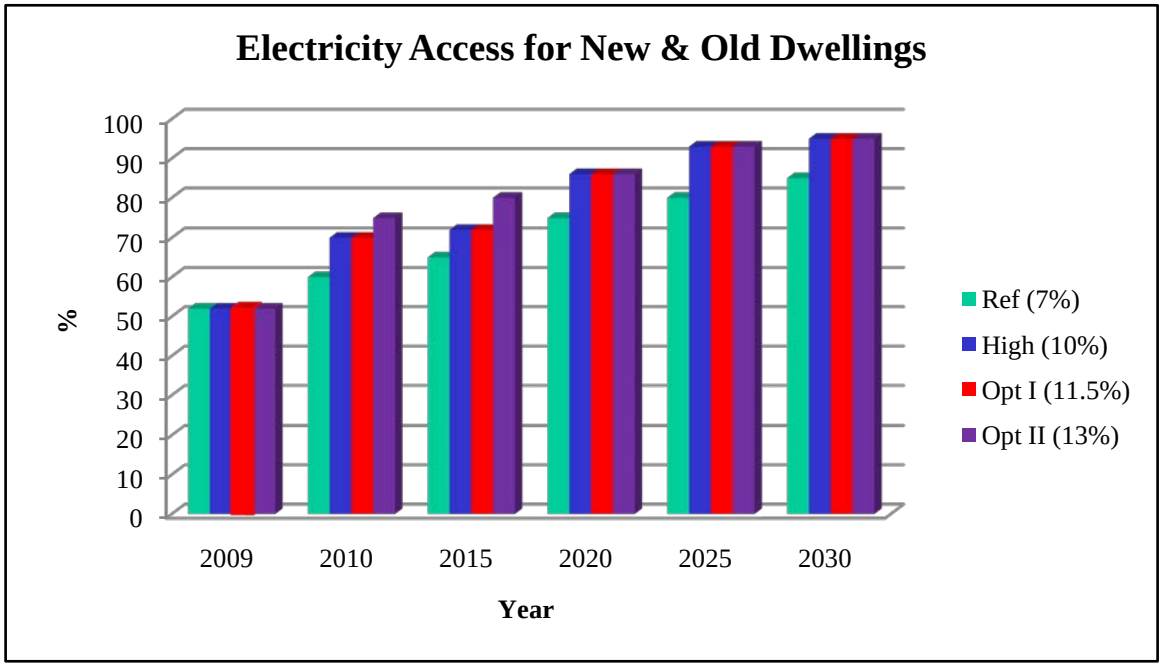


Figure 8. Projected Electricity Access

Source: ECN (2010)

3. Where Do We Want to Be

a) Petroleum

- To have a conducive business environment for petroleum industry operations
- Have enhanced exploration and exploitations of petroleum resources for the benefits of Nigeria
- Optimized domestic gas supplies particularly for power generation and industrial development
- Have a progressive fiscal framework that encourages further investment in the petroleum industry, while optimizing the revenue accruing to government
- Established commercially oriented and profit driven O/G entities
- Deregulated and liberalized downstream petroleum sector
- Efficient and effective regulatory agencies
- Openness and transparency in the industry
- Enhanced local content in the petroleum industry.
- Oil reserves of 40 billion barrels and production of 4mb/d by 2020

3. Where Do We Want to Be

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Table 14. Projected Total Energy Demand for Fuel Petroleum Products for Nigeria (Million Litres)

Year	PMS		DPK		AGO		Fuel Oil		LPG	
	7%	13%	7%	13%	7%	13%	7%	13%	7%	13%
2009	12,280	12,280	2,600	2,600	2,690	2,690	580	580	27.8	27.8
2010	15,070	18,230	3,290	3,780	6,040	7,310	1,469	2,664	75.9	150.6
2015	21,220	35,880	5,040	6,450	8,520	14,430	2,839	5,641	227.8	529.7
2020	29,830	61,090	7,370	9,950	11,990	24,610	4,604	11,909	614.9	1,263.0
2025	41,910	107,550	11,150	15,430	16,880	43,380	7,216	26,147	1,374.2	2,483.5
2030	58,830	196,960	17,210	28,820	23,720	79,510	16,029	58,873	2,442.8	4,281.8

Source: Energy Commission of Nigeria (2010)

3. Where Do We Want to Be

b) Coal/Lignites, Tar Sands/Bitumen and Nuclear Energy

- i) Coal and Lignite
  - To have a resuscitated coal industry through active private sector participation and with high local content
  - Adequate funding of coal to meet the energy and power requirement of the country in a cost effective and sustainable manner
- ii) Tar Sands/Bitumen
  - To have the tar sands/bitumen reserves explored and exploited through active private sector participation and high local content in an environmentally friendly manner for domestic and international markets
- Iii) Nuclear Energy
  - To have nuclear energy utilized for peaceful purposes
  - To have requisite manpower for peaceful use of nuclear power
  - To have adequate storage and disposal of nuclear waste in an safe and sustainable manner

3. Where Do We Want to Be Cont'd….

c) Renewables and Energy Efficiency

- To have renewable energy mainstreamed into the nation's commercial energy mix through active participation of private sector and high local content
- To have renewables to contribute about 20% in meeting the electricity demand by 2030
- To have energy efficiency and conservation best practices promoted and its effect doubled by 2030

3. Where Do We Want to Be Cont'd….

Table 15. Renewable Electricity Supply Projection in MW (13% GDP Growth Rate)

S/N	Resource	Now	Short	Medium	Long
1	Hydro (LHP)	1938	4,000	9,000	11,250
2	Hydro (SHP)	60.18	100	760	3,500
3	Solar PV	15.0	300	4,000	30,005
4	Solar Thermal	-	300	2,136	18,127
5	Biomass	-	5	30	100
6	Wind	10.0	23	40	50
	All Renewables	2025.18	4,628	15,966	63,032
	All Energy Resources	8,700 (installed Gen Capacity)	47,490	88,698	315,158
	% of Renewables	23%	10%	18%	20%
	% RE Less LHP	0.4%	1.3%	8%	16%

Short – 2015
Medium – 2020
Long – 2030

3. Where Do We Want to Be Cont'd….

Table 16. Small Hydro Power Projects for Investment

Name of Dam	State/Location	Capacity (MW)	Estimated Cost (US$)
Oyan	Ogun	10	7,500,000.00
Ikere Gorge	Oyo	6	11,000,000.00
Bakolori	Zamfara	3	4,275,000.00
Challawa	Kano	7.5	3,350,000.00
Tiga	Kano	10	44,562,500.00
Kampe	Kogi	3	8,125,000.00
Owena	Ondo	0.45	1,287,500.00
Doma	Nasarawa	1	4,900,000.00
Zobe	Katsina	0.3	1,531,250.00
Jibia	Katsina	4	91,250,000.00
	Total	45.25	177,781,250.00

Source: FMP 2014

3. Where Do We Want to Be Cont'd….

d) Power

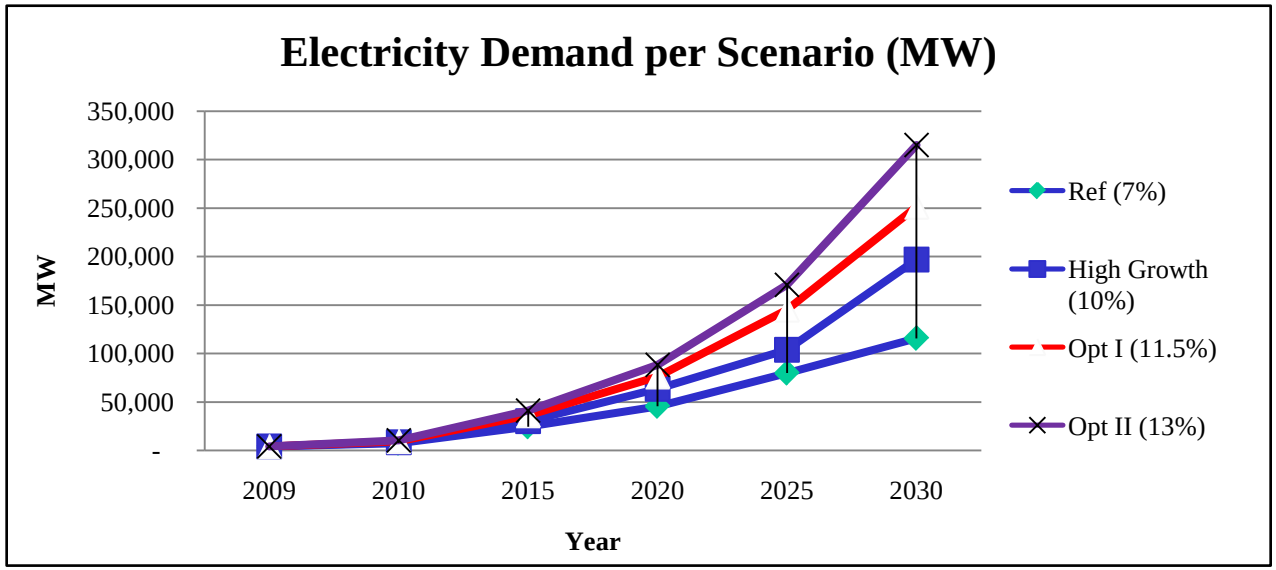
- That power contributes immensely to a double digit growth of the economy such that Nigeria becomes within the 20 largest economy in the world by 2020 or thereabout, through active private sector participation with high local contents and in an environmentally friendly manner. Projected power demand and supply for various scenarios from MAED and MESSAGE studies conducted as shown in the following tables

3. Where Do We Want to Be Cont'd….

Table 17. Electricity Demand Projections for Nigeria under various Economic Scenarios

	2009	2010	2015	2020	2025	2030
Ref (7%)	4,052	7440	24380 (14,000)*	45490 (40,000)**	79798	115674
High Growth (10%)	4,052	8420	30236	63363	103859	196875
Opt I (11.5%)	4,052	9400	36124	76124	145113	251224
Opt II (13%)	4,052	10230	41133	88282	170901	315113

*Power Roadmap Target (PRMT) by 2014 ** PRMT by 2020



Source: ECN, 2012

3. Where Do We Want to Be Cont'd….

Table 18. Electricity Supply Projections by Fuel Type : Optimistic II Scenario 7%

Fuel Type	2009	2010	2015	2020	2025	2030
Coal	0	609	1805	6527	7545	10984
Electricity import	0	0	0	0	0	31948
Gas	3803	4572	18679	33711	61891	80560
Hydro	1930	1930	3043	6533	6533	6533
Nuclear	0	0	1000	1500	2500	3500
Small hydro	20	60	172	409	894	1886
Solar	0	260	1369	3455	7000	25917
Wind	0	10	19	22	25	29
Biomass	0	0	3	16	35	54
Total	5753	7440	26092	52174	86422	161411

Source: ECN (2010)

3. Where Do We Want to Be Cont'd….

Table 19. Electricity Supply Projections by Fuel Type : Optimistic II Scenario 10%

Fuel Type	2009	2010	2015	2020	2025	2030
Coal	0	870	2579	9324	10778	15691
*Electricity import	0	0	0	0	0	45640
Gas	3803	6957	21328	44763	82702	115086
Hydro	1930	2174	4348	9332	9332	9332
Nuclear	0	0	1500	2500	3500	3500
Small hydro	20	81	246	585	1277	2694
Solar	0	377	1956	4936	10000	37025
Wind	0	18	28	32	36	42
Biomass	0	0	4	23	50	77
Total	5753	10476	31989	71495	117675	229086

Source: ECN (2010)

3. Where Do We Want to Be Cont'd….

Table 20. Electricity Supply Projections by Fuel Type : Optimistic II Scenario 11.5%

Fuel Type	2009	2010	2015	2020	2025	2030
Coal	0	1000	2966	10723	12395	18045
Electricity import	0	0	0	0	0	52486
Gas	3803	8000	23377	45728	106607	132348
Hydro	1930	2500	5000	10732	10732	10732
Nuclear	0	0	2500	4500	5500	6369
Small hydro	20	93	283	672	1469	3098
Solar	0	434	2250	5677	14127	42578
Wind	0	20	32	36	42	48
Biomass	0	0	4	27	58	88
Total	5753	12047	36412	78095	150929	265794

Source: ECN (2010)

3. Where Do We Want to Be Cont'd….

Table 21. Electricity Supply Projections by Fuel Type: Optimistic II Scenario 13%

Fuel Type	2009	2010	2015	2020	2025	2030
Coal	0	3353	3353	12122	14011	20399
Electricity import	0	0	0	0	0	59333
Gas	3803	13110	26426	49996	120512	164307
Hydro	1930	4157	11207	12132	12132	12132
Nuclear	0	0	3600	7200	7200	7200
Small hydro	20	105	320	760	1660	3502
Solar	0	490	2543	6417	15970	48132
Wind	0	23	36	41	47	54
Biomass	0	0	5	30	65	100
Total (supply)	5753	21238	47490	88698	171598	315158

Source: ECN (2010)

3. Where Do We Want to Be Cont'd….

Table 22. Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Reference Scenario

Resource	2015	2020	2025	2030
Coal	1.79	7.08	1.53	5.16
Gas	11.67	20.98	37.99	27.61
Hydro	2.78	8.73	0	0
Nuclear	2.5	1.25	2.5	2.5
Small Hydro	0.28	0.59	1.21	2.48
Solar	3.88	7.3	21.35	76.67
Wind	0.02	0.01	0.01	0.01
Biomass	0	0.02	0.03	0.03
Total	22.94	45.96	64.62	114.46

Source: ECN (2010)

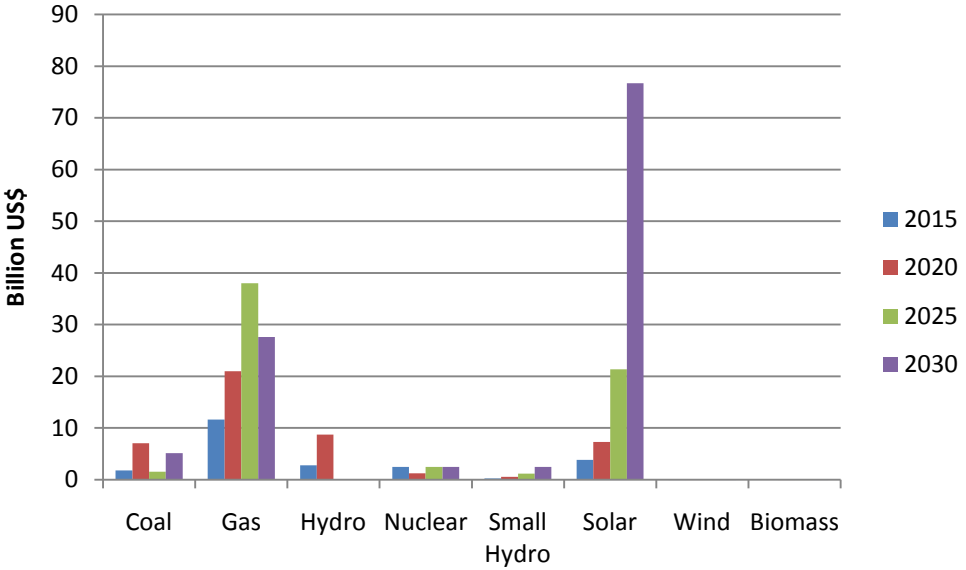
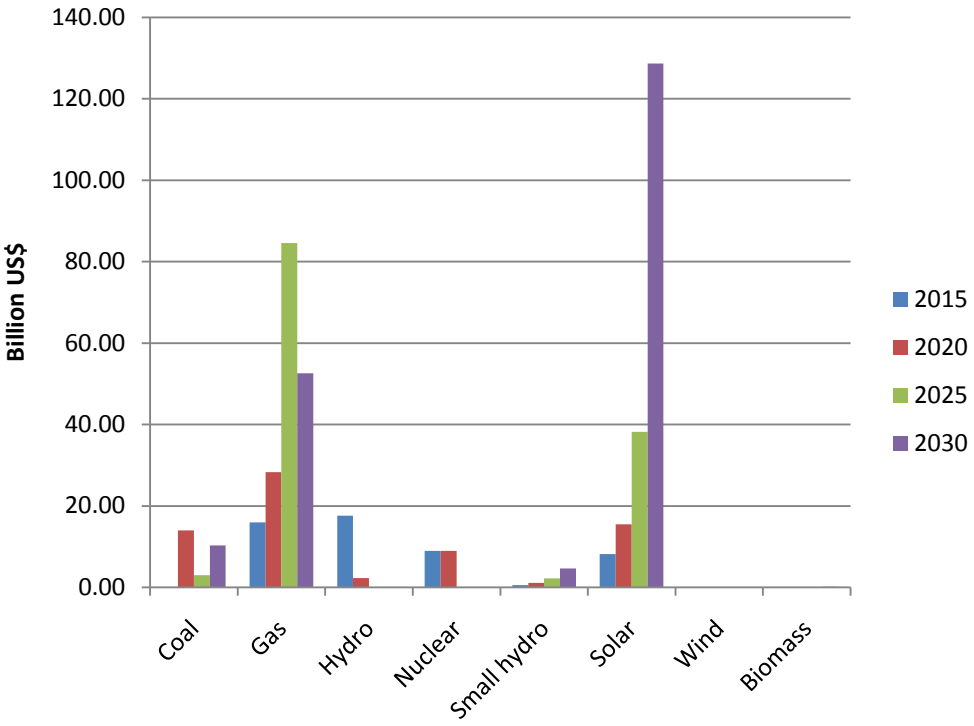


Figure 9. Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Reference Scenario

3. Where Do We Want to Be Cont'd….

Table 23. Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Optimistic II Scenario (13%)

	2015	2020	2025	2030
Coal	0.00	14.03	3.02	10.22
Gas	15.98	28.28	84.62	52.55
Hydro	17.63	2.31	0.00	0.00
Nuclear	9.00	9.00	0.00	0.00
Small hydro	0.54	1.10	2.25	4.61
Solar	8.21	15.50	38.21	128.65
Wind	0.03	0.01	0.01	0.01
Biomass	0.01	0.06	0.08	0.08
Total	51.39	70.29	128.19	196.12



Source: ECN (2010)

Figure 10. Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Optimistic II Scenario (13%)

4. Prospects, Challenges & Way Forward

a. Prospects

- There is a strong political will by Government towards private sector participation in the sector. The EPSR Act of 2005 provides legal framework for the power sector, while the PIB, when passed will do same for petroleum sub-sector
- There are opportunities for investment in diversifying the energy supply mix to include all viable energy sources in Nigeria
- There are investment opportunities in energy efficiency and conservation
- There are natural and statutory incentives available such as:
  - Big market of about 170 million people in Nigeria and 230 million in surrounding ECOWAS sub-region
  - Trainable resourceful and cost-effective workforce with 60% as youth
  - Relative absence of natural disasters/calamity e.g. earthquake, hurricane, etc.
  - High returns in investments (RoI) of between 35% and 45% generally
  - FGN guarantees backed by World Bank on PPAs
  - Zero import duties on power machinery and equipment
  - Unhindered repatriation of profit
  - Very low VAT regime of 5%
- Feed-in-Tariff available for renewables

4. Prospects, Challenges & Way Forward Cont'd….

b) Challenges

- Weak regulatory in the energy and power sector
- Natural gas supply constraints
- Inadequate sources of both local and international funds
- Inadequate local equipment and machinery manufacturing infrastructure
- Inadequate skilled manpower (Engineers, technicians, craftsman, etc.)
- Non passage of the PIB
- Inadequate synergy between energy related MDAs

c) Way Forward

- To sustain democracy, rule of law and enhanced security
- Passing of the PIB into law
- To enhance capacity building and R & D
- To attract local funds and FDI
- Strengthening of the regulatory agencies (DPR, PPPRA, NNRA and NERC)
- Strengthening of Energy Commission of Nigeria to deliver strategic plans and coordination of National Policies on energy in all its ramifications

5. Conclusion

- Government's political will towards active private sector participation in the energy and power sector remains ever strong
- The demand for energy and power in Nigeria will continue to grow in view of its growing population and the desire for fast industrialization.
- Opportunities for investment into electricity and other final energy forms' production, transmission and distribution from the varied and huge sources of energy in the country are enormous
- Statutory incentives are available to attract investments in the energy and power sector so that the economy can grow to be amongst the 20 largest economies in the world by 2020 and thereabout.
- There is the need to strengthen the energy regulatory agencies and the Energy Commission of Nigeria in order to have successful post deregulated and liberalized energy and power sector of the economy.

THANK YOU

AND

GOD BLESS