

Status of Energy Access in Nigeria*

By

Prof. E. J. Bala

**Ag. Director General/CEO,
Energy Commission of Nigeria, Abuja.**

Email: elijidere@yahoo.co.uk or
dg@energy.gov.ng

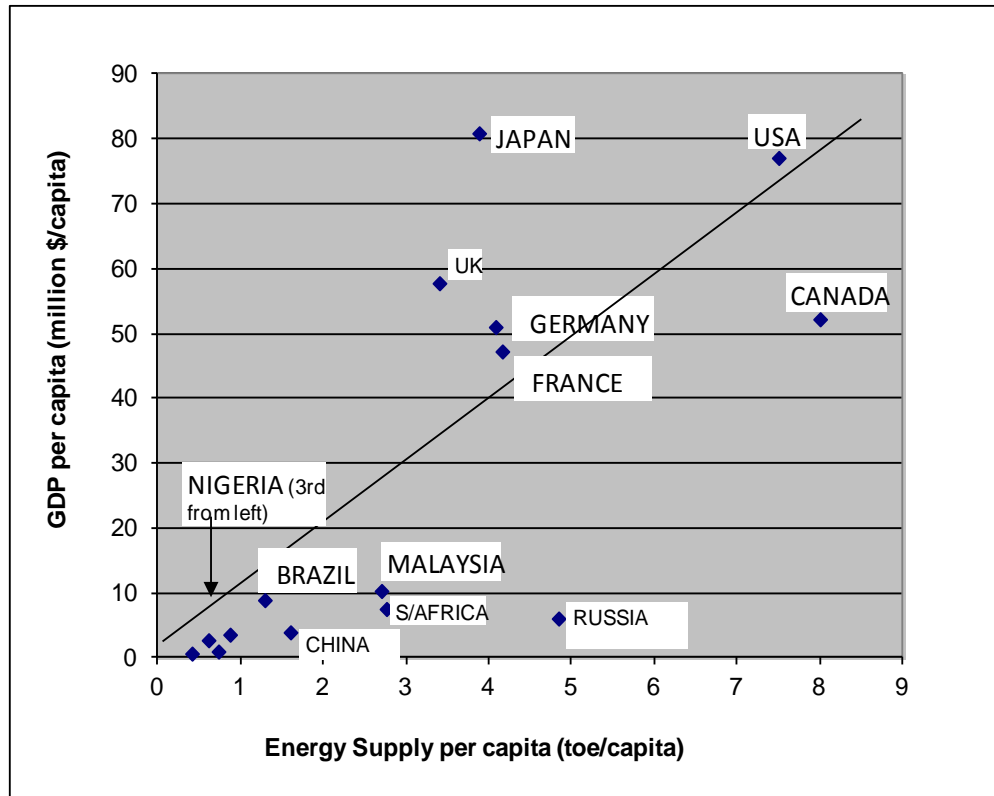
* Paper Presented at the Workshop on Energy Access and Village Inventory Organised by the World Energy Council , Johannesburg, 18th February 2013.

Outline

1. Introduction
2. Overview of Energy Resources in Nigeria
3. Energy Supply & the Economy
4. Energy Demand & Supply Projections
5. Energy Demand – Supply Imbalance
6. Opportunities for Improved Energy Access
7. Challenges to Improved Energy Access in Nigeria
8. Conclusion

1. Introduction

- Modern energy in the form of **electricity**, **fuel** and process **heat** is essential for national wealth creation, employment and improved standard of living.



1. INTRODUCTION.... Cont'd

- Electricity production in Nigeria began in 1896 with 2 x 30kW diesel generators in Lagos.
- By 1960, at independence, generation capacity was a little above 50MW of distributed power generation, when the population of the country was 43million. This resulted to 1.16W/capita.
- Grid generation capacity rose to 6000MW in 1990. Thereafter, and for about ten(10) years, no additional capacity was added until a year after 1999; in the contrary, some capacity were scrapped. Reforms in the sector, however, began from 1999 and now grid generation capacity has reached 8700MW; though availability is about 4500MW only, for a population of about 160million people. This results to 54.38W/capita.
- Oil and gas production in Nigeria began in 1956 with the first export of 5000 barrels in 1958.
- In 2011, crude oil and condensate production stood at 2.37million barrels a day, which translates to 868.25million barrels per annum. Natural gas production in 2011 was 2.4TSCF with 26% flared and 76% utilized. LPG production in the same year was 0.337million tonnes, with less than 0.1million tonnes utilized domestically.
- The first domestic oil refinery was in Port Harcourt in 1965 with an installed capacity of 35,000 barrels per day.

1. INTRODUCTION.... Cont'd

- Total installed domestic crude oil refining capacity grew to 445,000 barrels per day in 4 refineries, with the newest built in 1989. since then, no new refining capacity has been added up to date. The capacity utilisation is however low at an average of 24% in 2011. Most of the products now utilized within the country are imported. NNPC, through the PPMC, distributed 15.58million litres/day of PMS, 2.68million litres/day of AGO and 2.47million litres/day of HHK within the same year. It is estimated that the four(4) major marketers distributed over 50% of the total products consumed in 2011.
- Coal production in Nigeria began in 1916 in Enugu with production output of 24,511 tonnes per annum.
- Production peaked in 1959 with an output of 905,397 tonnes per annum. Production ceased during the 1966 -1970 civil hostilities. After the hostilities, production peaked again in 1972 at 323,001 tonnes per annum. Thereafter, it began to decline and stopped in 2001.
- Traditional fuel, in the form of firewood, mainly for cooking and heating has continued to constitute over 80% in meeting the domestic energy needs of rural people and urban poor.

2. Overview of Energy Resources in Nigeria

a) Fossil Energy Resources and Nuclear Energy Sources

S/N	Resources	Reserves	Production (2010)	Domestic Utilization (2010)
1	Crude Oil	37.2billion barrels	0.896billion barrels	0.164billion barrels
2	Natural Gas	187 Tscf	2.392Tscf	75.7% - Fuel, Industries, re-injection and gas lift. 24.3% - gas flare
3	Coal	2.7 billion tonnes	0	Negligible
4	Tar Sands	31 billion barrels of oil equivalent	0	0.224 million tonnes
5	Nuclear	Yet to be quantified	0	30kW experimental nuclear reactor

2. Overview of Energy Resources.... contd

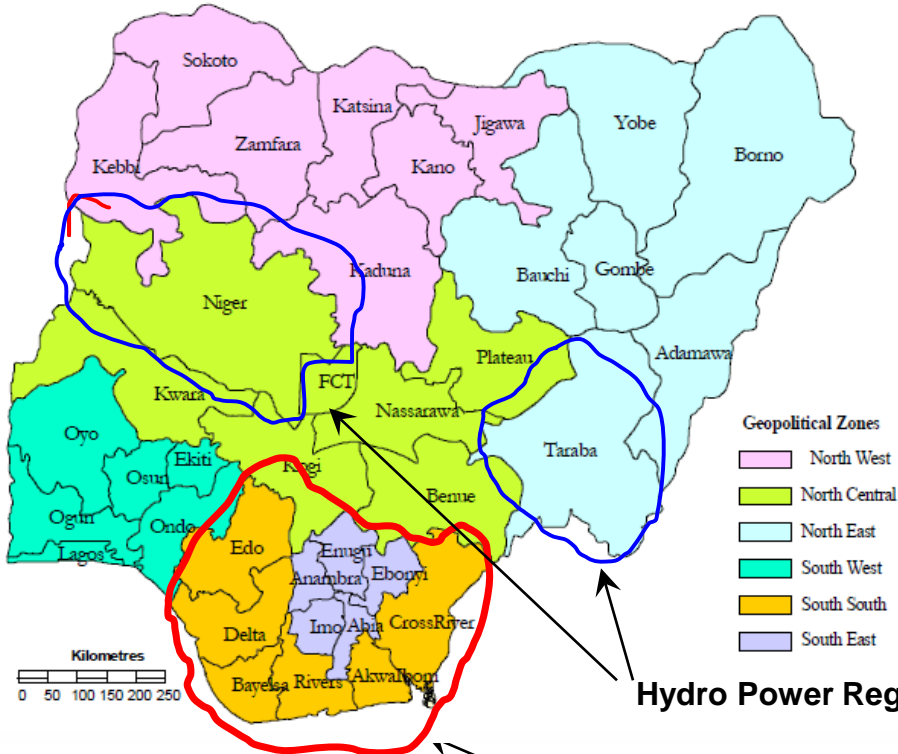
b) Renewable Energy Resources

S/No	Resource	Reserve	Utilization Level	
1	Large hydro power	11,250MW	1,900MW	
2	Small Hydro power	3,500MW	64.2MW	
3	Solar Energy	4.0kWh/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	- 28.2 million hectares of Arable land	8.5% cultivated

2. Overview of Energy Resources...Contd

Viable Solar Power Region

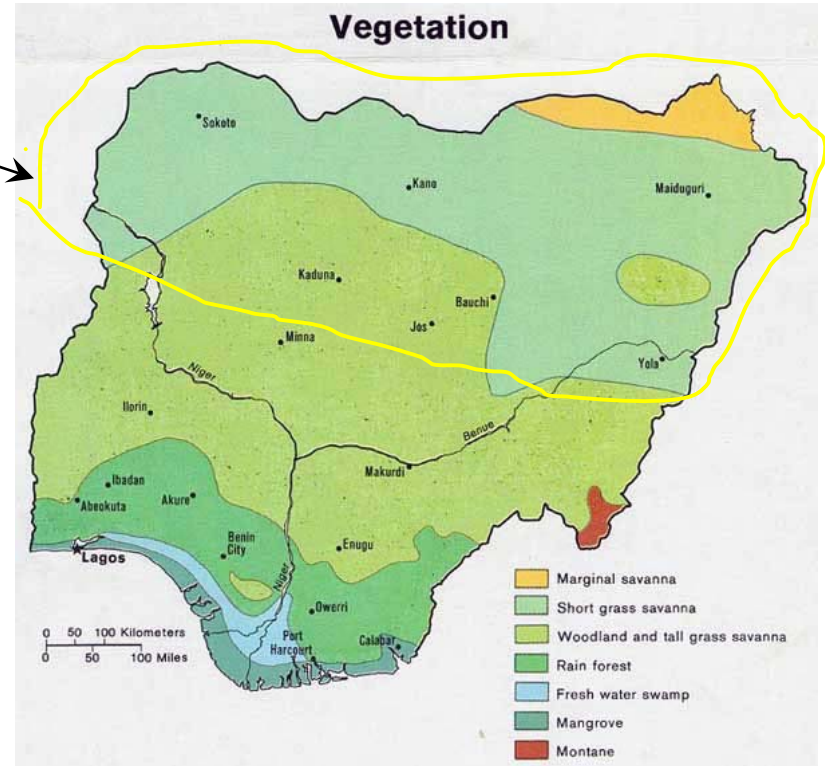
Nigerian Geo-political Zones



Hydro Power Region

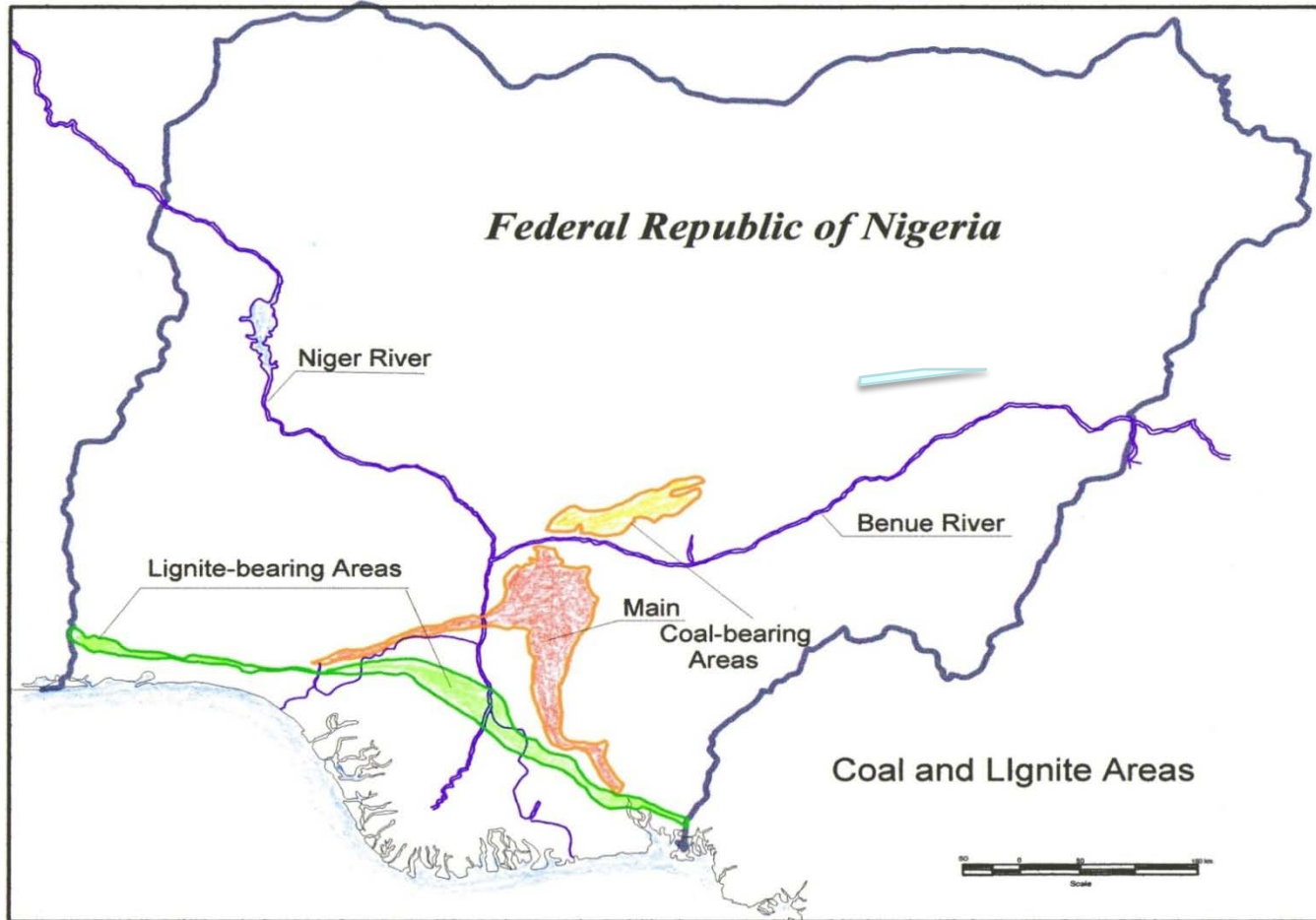
Oil & Gas & Thermal Power Plants Region

Vegetation



2. Overview of Energy Resources...Contd

COAL & LIGNITE DEPOSITS OF NIGERIA



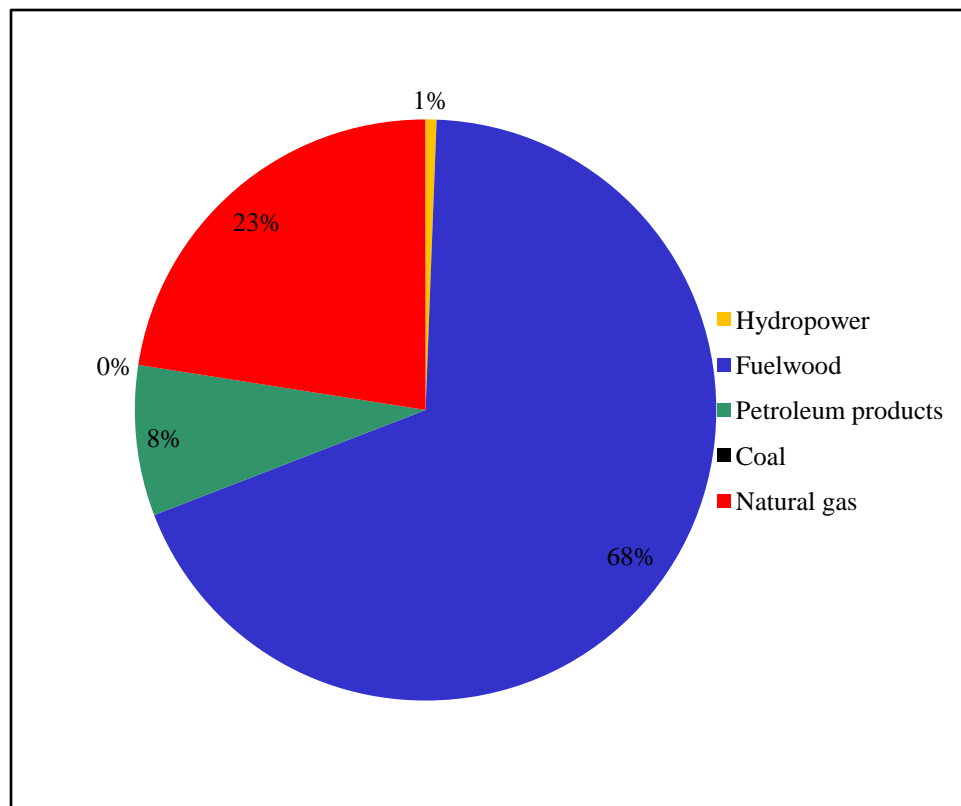
(MODIFIED AFTER BEHRE DOLBEAR, 2005)

Source: Nigerian Coal Corporation (2009)

3. Energy Supply and Economy

Energy Consumption in Nigeria (2010)

Energy Form	Consumption, TOE	Percent of consumption
Hydropower	641,947.38	0.60
Fuelwood	72,872,800.00	68.52
Petroleum products	8,874,342.61	8.34
Coal	5600	0.01
Natural gas	23,955,518.05	22.53
Total	106,345,168.03	100.00



Percentage contribution by Energy Form

3. Energy Supply and Economy... contd

S/N	ITEMS	2003	2004	2005	2006	2007	2008	2009
1.	Electricity generation (billion kWh)	22.03	23.9	24.22 (503)* (10,695)**	23.8	23.3	21.27 (562)* (18,603)**	20.8
2.	Energy Consumption per Capital (kgoe/Capita)	151.3	125.5	132.6 (680)* (1,780)**	87.1	81.4	80.8 (670)* (1,830)**	83.1
3.	Electricity Consumption/capita (kWh/Capita)	174.6	176.4	181.4 (563)* (2596)**	167.6	161.2	142.9 (571)* (2782)**	135.2
4.	GDP/Capita (US\$/Capita)	620.7	658.0	826.3 (2314)* (8,492)**	1030.3	1223.5	1286.3 (2540)* (9550)**	1,106.8
5.	Energy Intensity (kgoe/ US\$)	0.244	0,191	0.161 (0.294)* (0.210)**	0.085	0.067	0.063 (0.264)* (0.192)**	0.075
6.	GDP Growth Rate (%)	9.6	6.6	6.5	6.0	6.5	6.0	6.7
7.	Electricity Access (%)				55.2% from 40% in 1993			60%
8.	Incidence of Poverty			54.4	54.0	54.0	54.0	54.0

Sources: CBN (2005-2010), NCC, Osogbo (2009),

***Africa Average - IEA (2007, 2010)**

****World Average - IEA (2007, 2010)**

4. Energy Demand and Supply Projections for Nigeria

- In Nigeria's vision for fast economic growth and development, it has envisioned to grow the economy at a rate of 11% - 13% so that it can be reckoned within the 20 largest economies in the world by 2020.
- In view of the relationship between GDP and energy consumption, the question that arises from our Vision 2020 is: how much energy would be required to attain it.

4. Energy Demand and Supply Projections for Nigeria

- The Energy Commission of Nigeria, in search of answers to the above went into partnership with the IAEA to have a quantitative insight into Nigeria's energy demand and supply using MAED and MESSAGE energy planning models of IAEA.
- Taking into consideration the economic vision, demography, available energy resources and modern developmental path, the models indicated that huge amount of energy in the forms of electricity, fuels and heat would be required to meet this vision.
- Whereas MAED is a scenario – based model, MESSAGE is an optimization model which also takes into consideration general environmental impacts.

4. Energy Demand and Supply Projections for Nigeria... contd

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

4. Energy Demand and Supply Projections for Nigeria.... contd

– **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.

4. Energy Demand and Supply Projections for Nigeria.... . contd

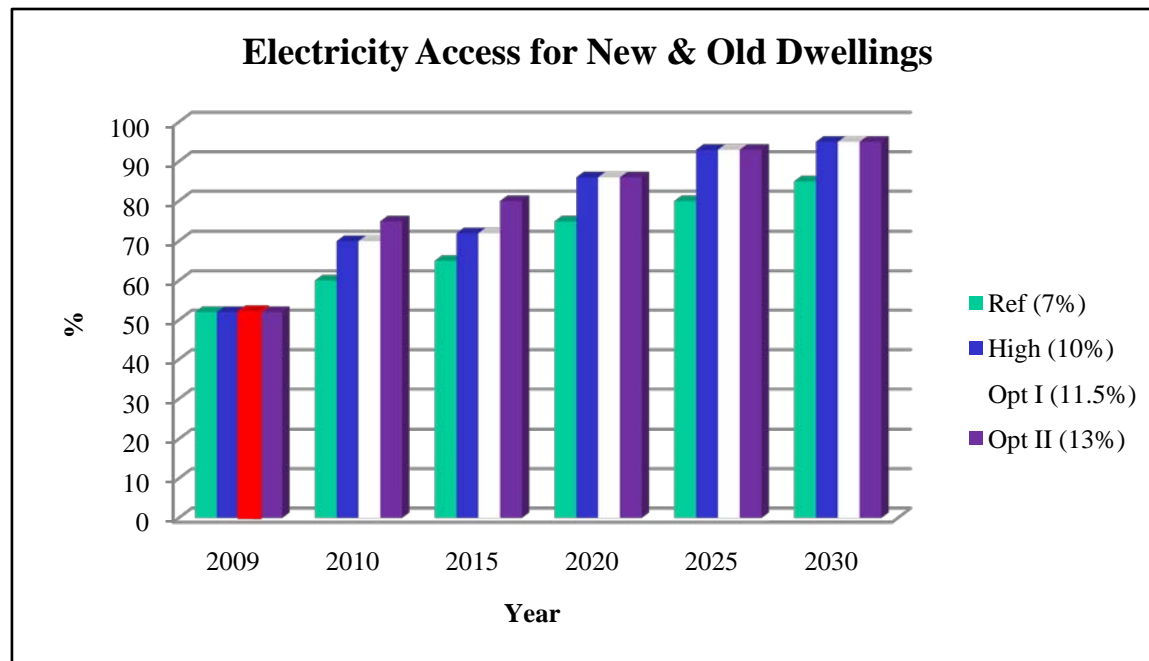
Demographic Assumptions

Parameter	2010	2015	2020	2025	2030	2035	2040
Population growth rate	3.16	3.52	3.80	4.00	4.00	3.88	3.74
Number of persons per household	5.2	5.60	5.60	5.40	5.20	5.00	4.00
Number of households	30.0	33.7	42.1	53.2	67.3	84.8	101.9

4. Energy Demand and Supply Projections for Nigeria.... . contd

Electricity Access for Old and New Dwellings (%)

	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



4. Energy Demand and Supply Projections for Nigeria.... . contd

a) Projected Sectoral Energy Demand in Nigeria based on 7% Growth Rate

S/ N	Sector	2005 (Base Yr)	2010	2015	2020	2025	2030
1.	Industry (%)	13.81	28.92	37.01	40.75	44.69	48.78
2.	Transport (%)	30.80	27.62	24.56	22.92	22.27	21.62
3.	Household (%)	49.23	38.16	33.05	30.62	27.27	24.12
4.	Services (%)	6.13	5.30	5.39	5.72	5.78	5.49
	Total (mtoe)	32.14	49.92	76.45	112.67	158.95	224.54

Source: Energy Commission of Nigeria (2008)

- These projections are based on the Model for the Analysis of Energy Demand (MAED) of the IAEA.
- The projections are also based on the preferred scenarios of development for the country, where industry would make the highest contribution to GDP.

4. Energy Demand and Supply Projections for Nigeria.... . contd

b) Projected Sectoral Energy Demand in Nigeria based on 13% Growth Rate

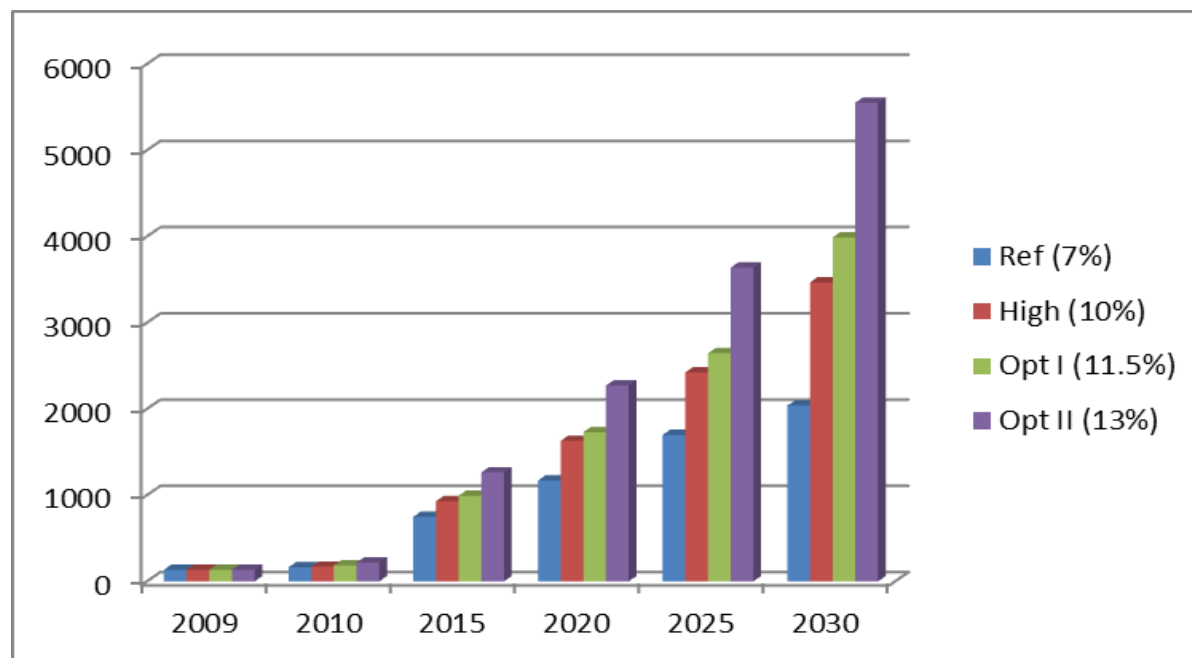
S/ N	Sector	2005 (Base Yr)	2010	2015	2020	2025	2030
1.	Industry (%)	13.81	27.91	40.87	51.91	62.89	71.39
2.	Transport (%)	30.80	26.78	23.24	20.86	18.55	16.51
3.	Household (%)	49.23	38.46	28.84	21.26	14.08	8.95
4.	Services (%)	6.13	6.86	7.05	5.97	4.48	3.15
	Total (mtoe)	32.14	59.45	109.97	202.74	387.52	747.27

Source: Energy Commission of Nigeria (2008)

4. Energy Demand and Supply Projections for Nigeria.... . contd

Electricity Demand per Capita (KWh/cap)

	2009	2010	2015	2020	2025	2030
Ref (7%)	135.2	164	749	1170	1699	2038
High (10%)	135.2	170	929	1630	2424	3468
Opt I (11.5%)	135.2	185	994	1730	2645	3990
Opt II (13%)	135.2	220	1264	2271	3638	5551

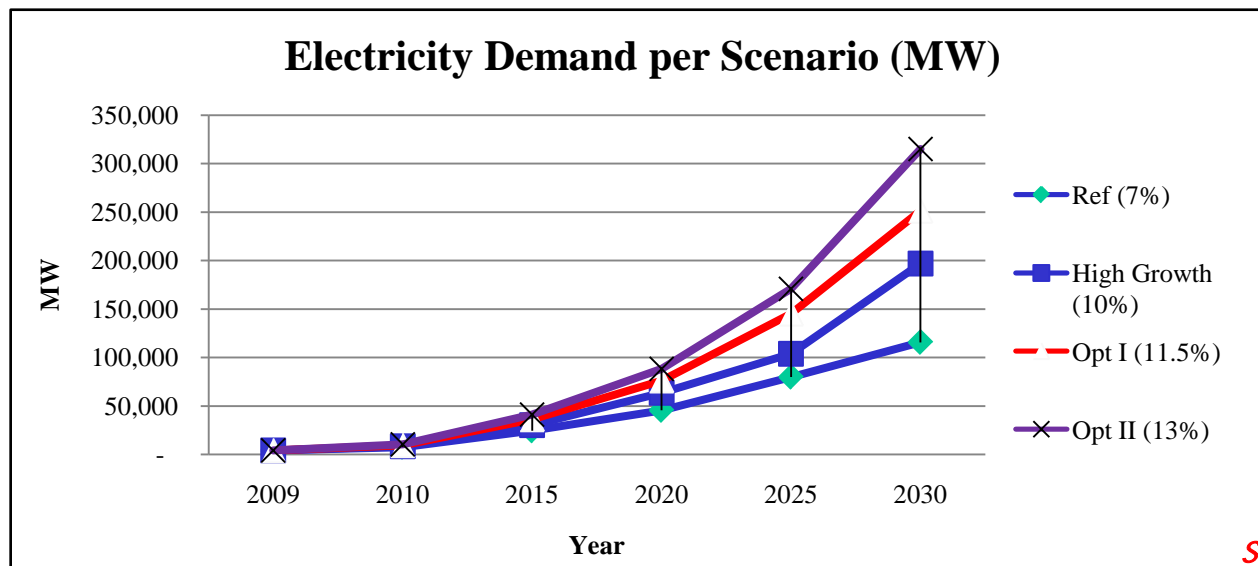


4. Energy Demand and Supply Projections for Nigeria.... . contd

Electricity Demand Projections Per Scenario, MW

	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



4. Energy Demand and Supply Projections for Nigeria..... contd

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%
2005	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 (2009)

4. Energy Demand and Supply Projections for Nigeria..... contd

Projected Electricity Supply by Fuel Type Based on 13% Economic Growth Rate (MW)

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0.00	3352.9818	3352.9818	12,121.794	14,011.266	20,398.634
Electricity Import	0.00	0	0	0	0	67727
Gas	3803.00	13109.77	26426.06	49,996.468	120,512.45	164,306.85
Hydro	1930.00	4157	11207	12132	12132	12132
Nuclear	0.00	0.00	3599.995	7199.99	7199.99	7199.99
Small hydro	20.00	105	319.9	759.85	1660.05	3502.1
Solar	0.00	490.35	2543.303	6417.268	15969.94	39737.5
Wind	0.00	23	36	41	47	54
Biomass	0	0	5	30	65	100
Supply	5746.00	21,238.09	47,490.24	88,698.37	171,597.69	315,158.07

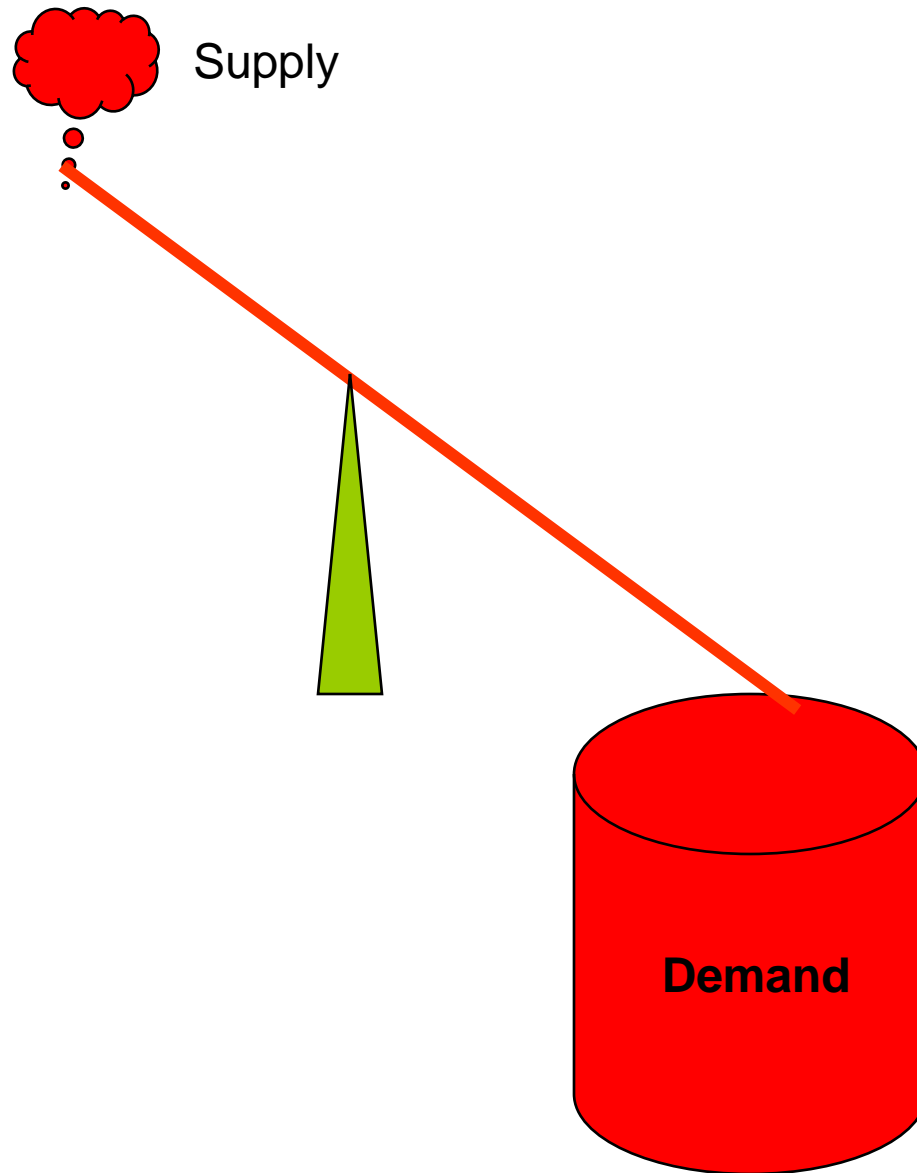
4. Energy Demand and Supply Projections for Nigeria..... contd

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

5. Energy Demand –Supply Imbalance

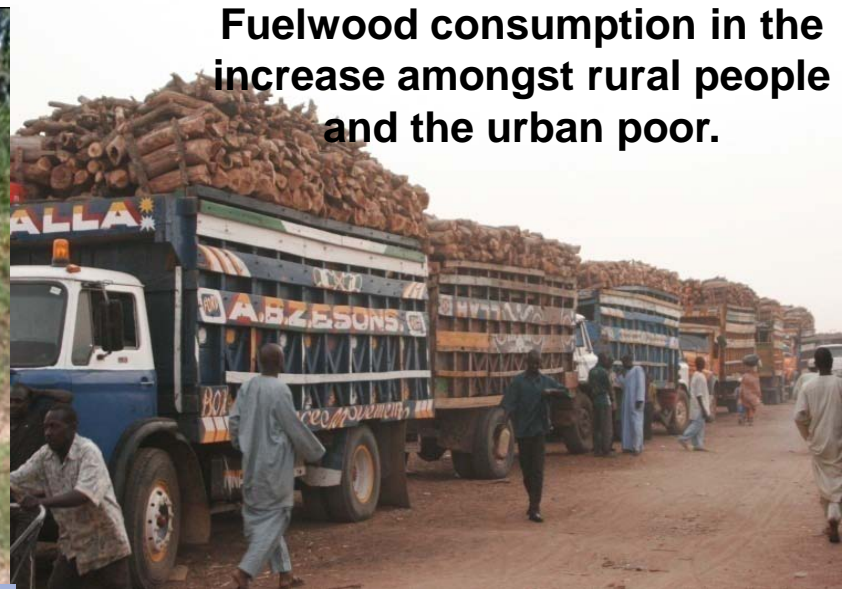


5. Energy Demand- Supply Imbalance



- Inefficient centralized grid has led to the installation of small-scale diesel and petrol engines as alternative to grid power.
- Resulting to in-door/out-door air pollution with health hazards that result into death in many cases.

5. Energy Demand – Supply Imbalance ... contd



Fuelwood consumption in the increase amongst rural people and the urban poor.



6. Opportunities for improved Energy Access in Nigeria.

- Implementation of the Roadmap for Power Sector Reform;
- Conclusion of the Petroleum Industry Bill;
- Expansion of the nation's energy supply mix to include coal, nuclear and renewables in line with the National Energy Policy & its Masterplan; and
- Adoption of best practices in energy efficiency and conservation.

7. Challenges to Improved Energy Access in Nigeria

- ***The Challenges of Privatization Policy Implementation:***
 - **The Power Sector is faced with Labour issues as well as human capacity challenges. The Petroleum Industry Bill is going through the rigour of the National Assembly.**
- ***Low Capacity Utilisation of Existing Energy Infrastructure***
 - ***Due to poor maintenance and vandalism. This is expected to be a thing of the past with privatisation.***
- ***Unacceptable Poverty Level in the Country***
 - ***Poverty level of about 55% , does not allow for enhanced energy access. Privatisation and rule of law is expected to improve on the poverty level, through creation of jobs and reduction of leakages within the economy***

8. Conclusion

- **Nigeria is endowed with abundant conventional and renewable energy resources. When properly harnessed into modern energy, energy access can be enhanced and the economy grown into one of the large world economies.**
- **The present gap between energy demand and supply is a matter that the Government is determined to address for good through its privatization and liberalization policy of the energy sector.**
- **While serious efforts are on to ensure sustainable energy supply in the country, entrenching energy efficiency and conservation best practices to improve access is imperative.**

Thank You All and God
Bless