



Nigeria's Readiness For Renewable Energy Revolution*

By

**Professor Eli Jidere Bala
Director General,
Energy Commission of Nigeria, Abuja.
dg@energy.gov.ng or elijidere@gmail.com**

***Presentation at the Annual Powering Africa Forum held 12-14
October 2016, at Hilton Transcorp, Abuja**

Contents



1. Introduction
2. Energy and Development
3. Energy Resources in Nigeria
4. Energy Demand Projection Scenarios
5. Electricity Supply Projections
6. Drivers for Renewable Energy (RE) in Nigeria
7. Conclusion

1.

Introduction

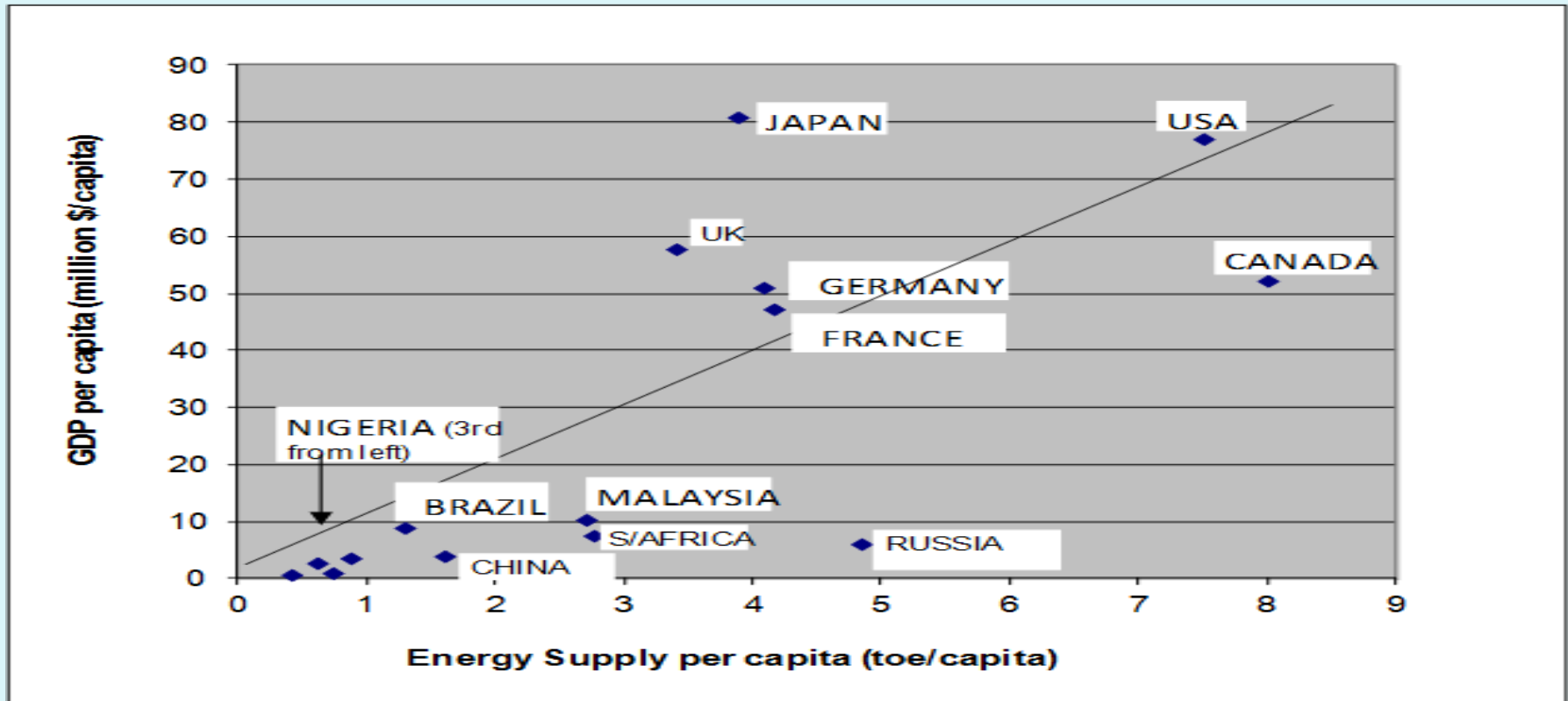
- Energy Commission of Nigeria came to being through the enabling Act No. 62 of 1979, as amended by Act No. 32 of 1988 and Act No. 19 of 1989 and is ***mandated by law to produce strategic plans and co-ordinate national policies in the field of energy in all its ramifications. It also, inter alia, make recommendations for the exploitation of new sources of energy.***
- The Commission commenced operation in 1989 after the meeting of the heads of ECOWAS in 1982 at Cotonou, where a resolution was made that each member state should establish an agency to be called Energy Commission charged with the responsibilities of coordinating and supervising all energy functions and activities within each Member States and may be called ENERGY COMMISSION.

1. Energy and Development



Energy has been acknowledged since the time of industrial revolution to be very essential for economic and human development for economic and human development.

(a) Energy and Economic Development



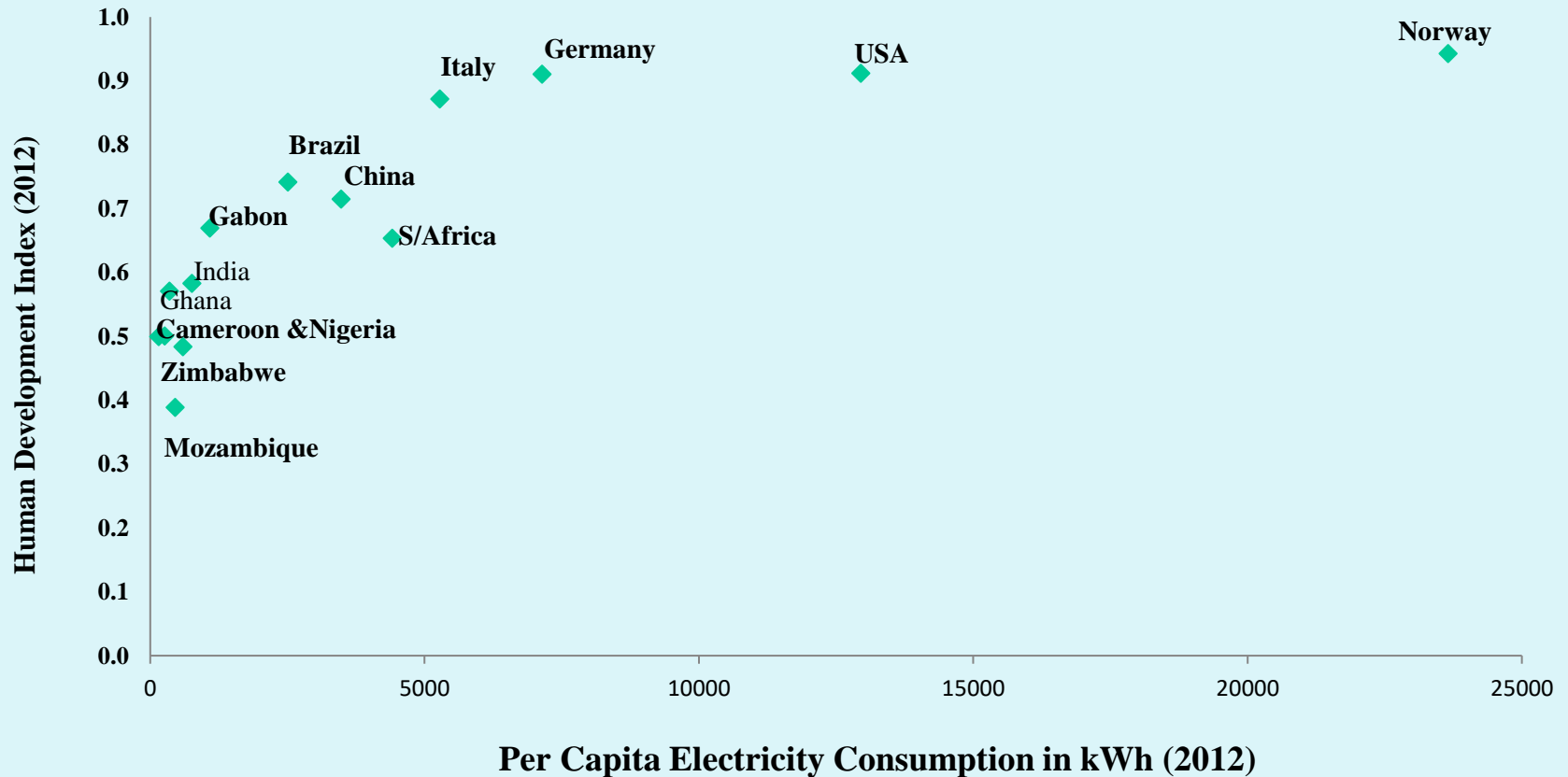
Graphical representation of the relationship between Energy and the Economy (IEA, 2010)

1. Energy and Development



(b) Energy and Human Development

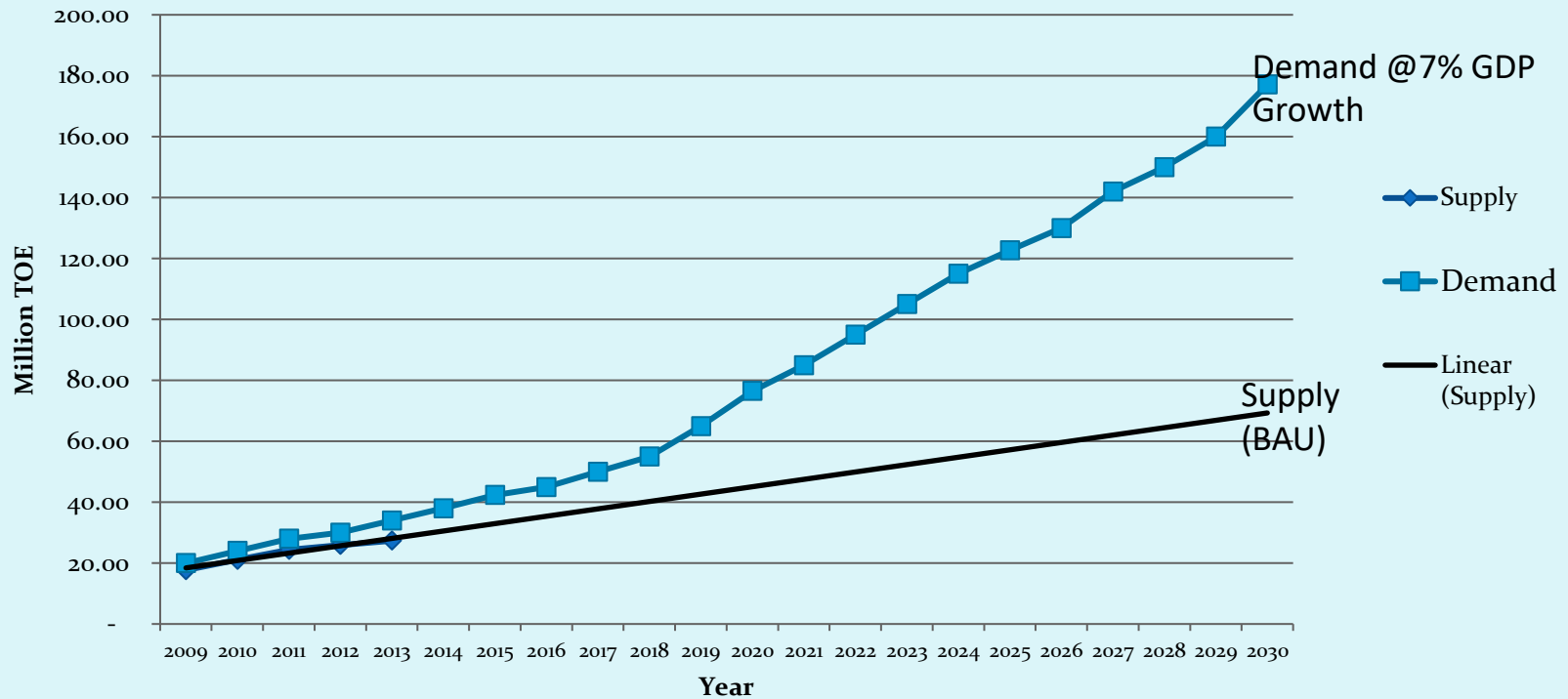
Relationship of HDI and Per Capita Electricity Consumption



Source: Human Development Report 2014 and IEA Key Energy Statistics 2014

- It is imperative to emphasise the fact that the present and future prosperity of Nigerian will be challenged by the capacity to meet increasing modern energy demand.

Modern Energy Demand and Supply (Million TOE)



Source: ECN (2015)

2. Energy Resources in Nigeria



a) Fossil Energy Resources and Nuclear Energy Sources

S/N	Resources	Reserves	Production (2014)	Domestic Utilization (2014)
1	Crude Oil	37.1 billion barrels	0.661 billion barrels	0.145 billion barrels
2	Natural Gas	188.7 Tscf	3.2 Tscf	88% : Utilized 12% : 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: OPEC (2015)

2. Energy Resources in Nigeria ... Cont'd



b) 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	30MW 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 only 8.5% is cultivated

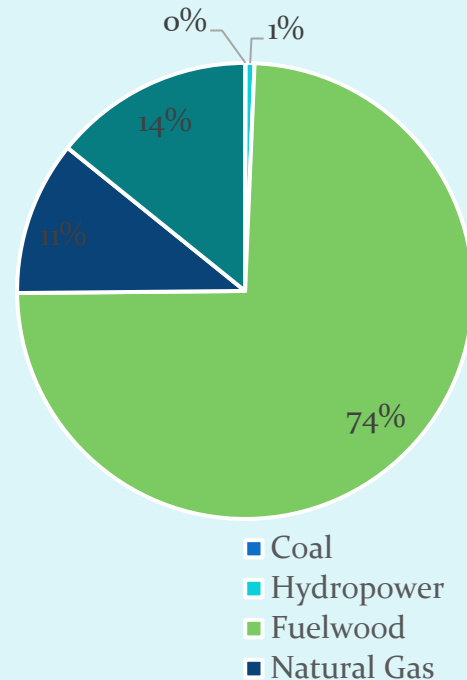
Source: Renewable Energy Master Plan (REMP)

3. Energy Demand



- In 2014, out of total primary energy consumption of 81.92Mtoe, natural gas accounted for 10.95%, fuelwood (74.19%), petroleum products (14.2%) and hydropower (0.63%), while coal contribution had declined to an insignificant level of 0.038% (Source: NEMP 2014)

Total Primary Energy Consumption in Nigeria (2014)

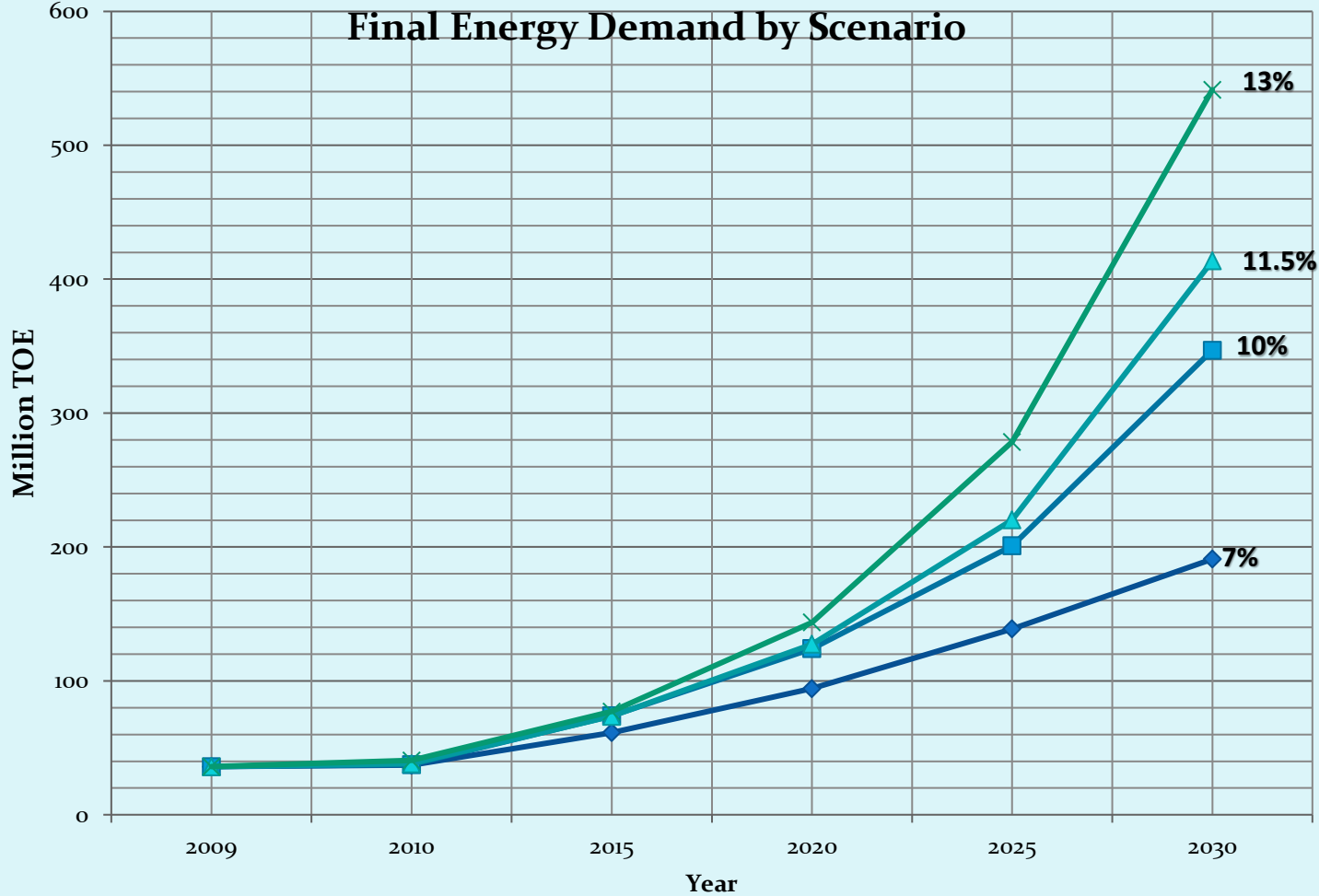


NEMP, 2014

3. Energy Demand Cont'd



(a) Final Energy Demand Projection up to 2030 by Scenario



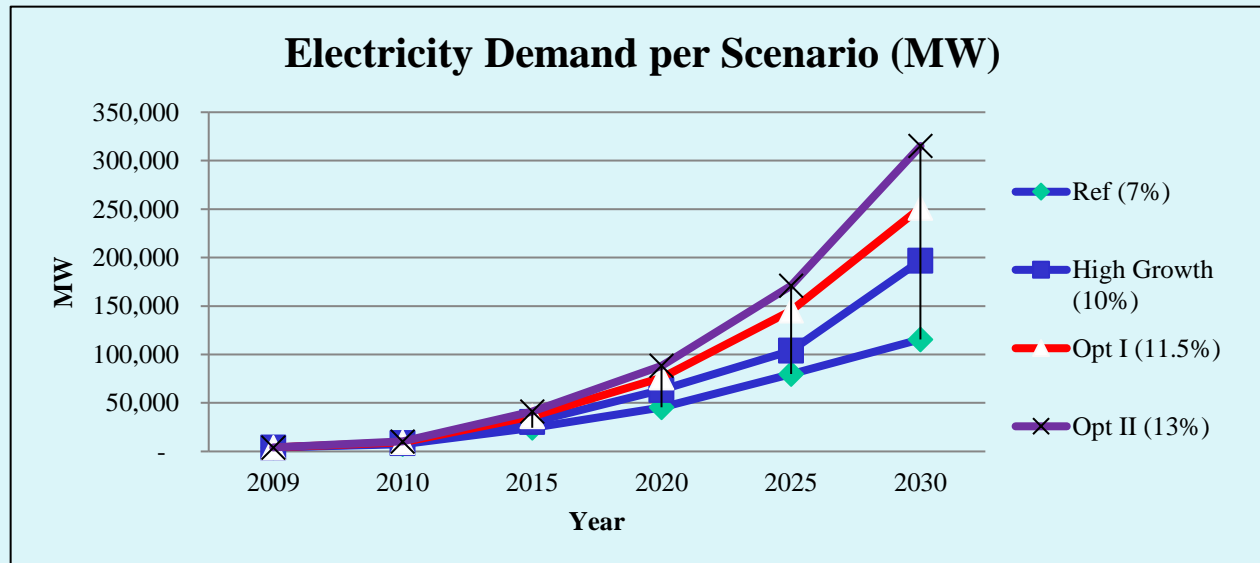
- ◆ Reference (7%)
- High Growth Scenario (10%)
- ▲ Optimistic I Scenario (11.5%)
- ✕ Optimistic II Scenario (13%)

3. Energy Demand Cont'd

(b) 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



(c) Projected Demand for Fuel Petroleum Products for Nigeria

Year	PMS (Million litres)		DPK (Million litres)		AGO (Million litres)		Fuel Oil (Million litres)		LPG (Thousand tonnes)	
	7%	13%	7%	13%	7%	13%	7%	13%	7%	13%
2009	5096.9	5096.9	356.1	356.1	565.6	565.6	120.0	120.0	74.2	74.2
2010	6180.0	8890.0	464.0	902.0	791.7	1177.9	160.0	270.0	93.2	132.9
2015	14460.0	19510.0	3788.0	7039.0	2301.9	3651.0	1800.0	3380.0	1107.0	1871.2
2020	28170.4	35587.1	9038.7	22704.5	4176.8	6270.8	4632.1	9277.9	2862.5	5733.5
2025	39769.4	55459.4	15084.9	44285.4	6231.8	11408.4	7806.1	20797.4	4824.0	12852.3
2030	56457.2	88369.2	22064.9	77255.7	8902.4	21349.7	11374.6	45443.4	7029.2	22903.7

Source: Energy Commission of Nigeria (2010)

4. Electricity Supply Projections

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

Source: ECN

4. Electricity Supply Projections

... Cont'd



(ii) Bio fuels Targets (Million Litres per Annum) for 13% growth scenario.

S/N	Item	Timeline/Quantity		
		Short	Medium	Long
1	Bio Ethanol (E10)	1951	3559	8837
2	Biodiesel (B20)	730	1254	4270

Source: ECN

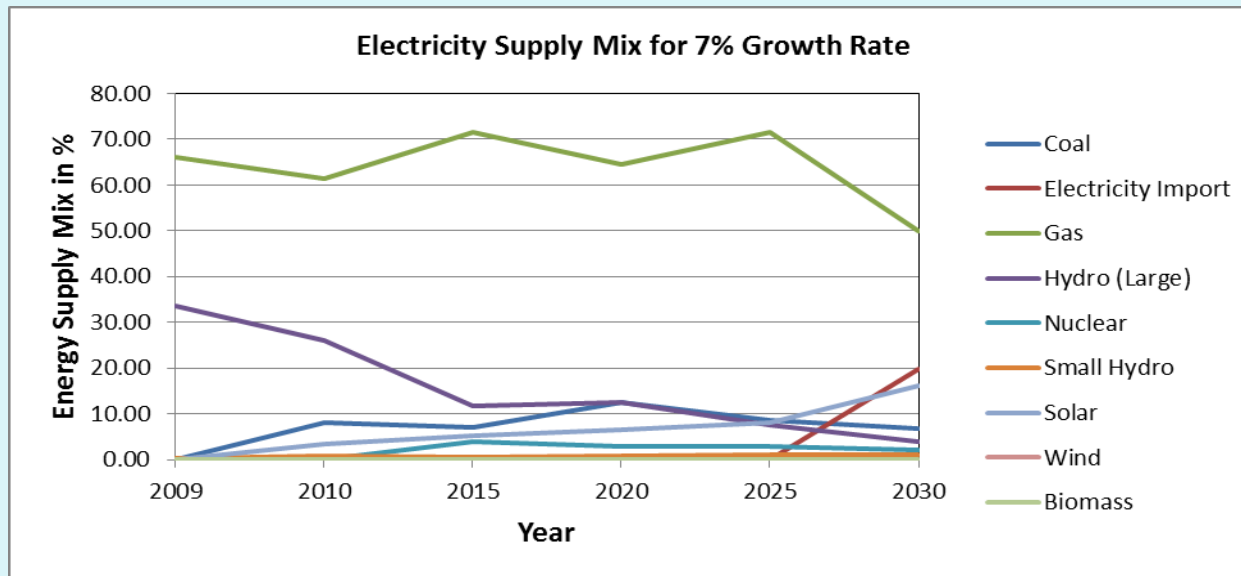
4. Electricity Supply Projections

... Cont'd



Table 3a: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 7%

	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	609	1850	6527	7545	10984
Electricity Import	0	0	0	0	0	31948
Gas	3803	4572	18679	33711	61891	80560
Hydro (Large)	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
Supply	5753	7440	26092	52174	86422	161411



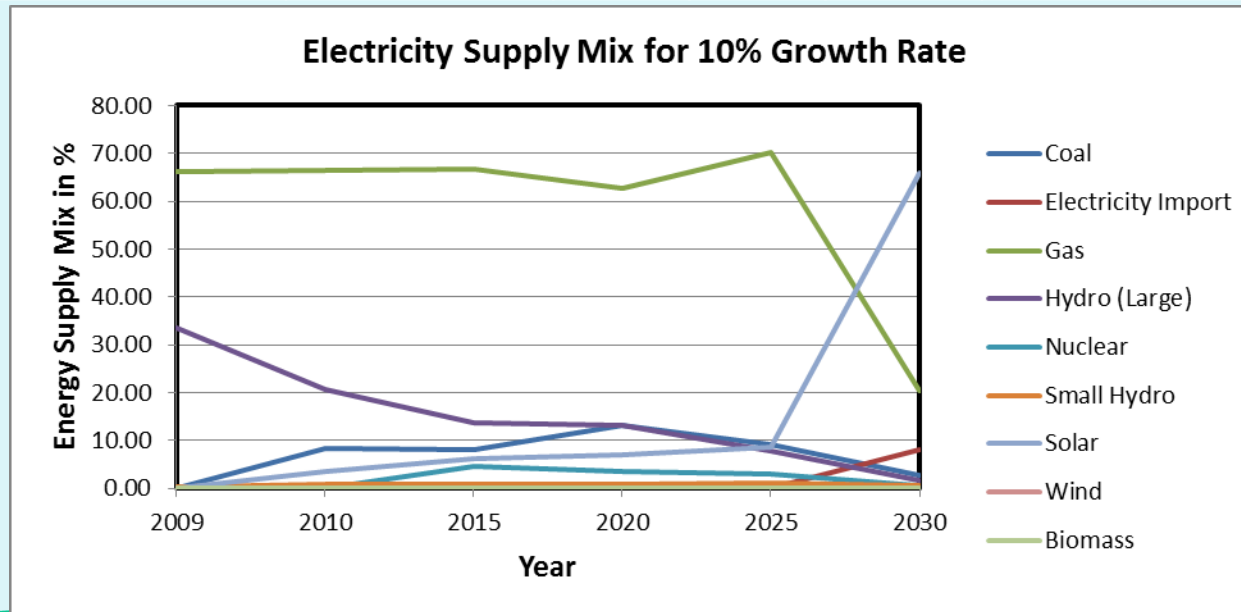
4. Electricity Supply Projections

... Cont'd



Table 3b: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 10%

	2009 (Based Yr)	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 (Large)	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	370225
Wind	0	18	28	32	36	42
Biomass	0	0	4	23	50	77
Supply	5753	10476	31989	71495	117675	229086



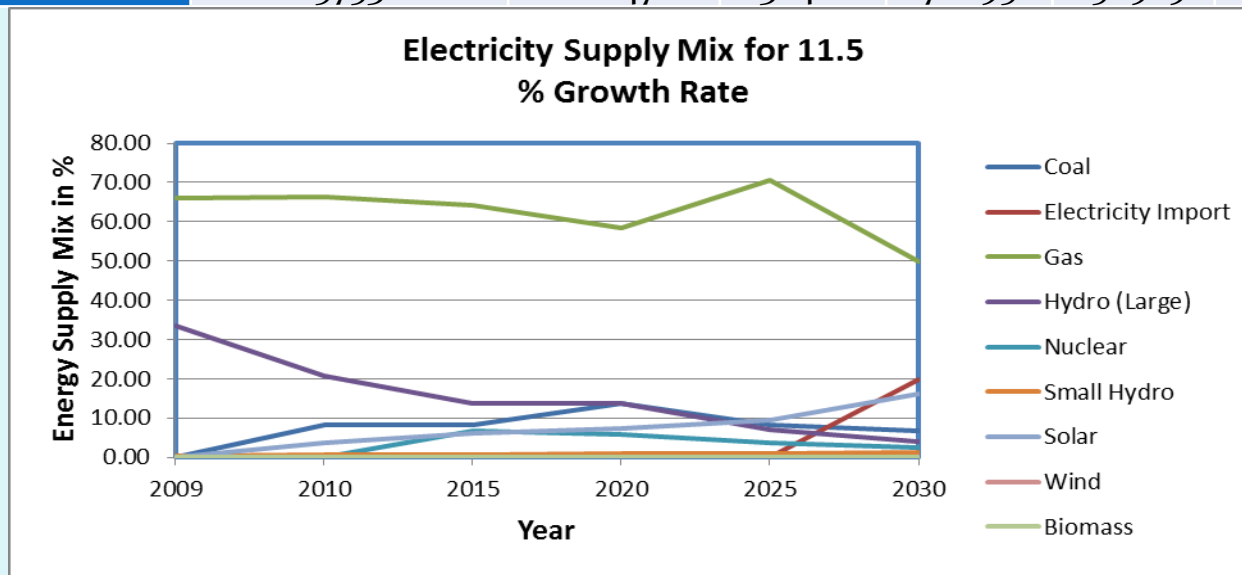
4. Electricity Supply Projections

... Cont'd



Table 3c: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 11.5%

	2009 (Based Yr)	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 (Large)	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
Supply	5753	12047	36412	78095	150929	265794



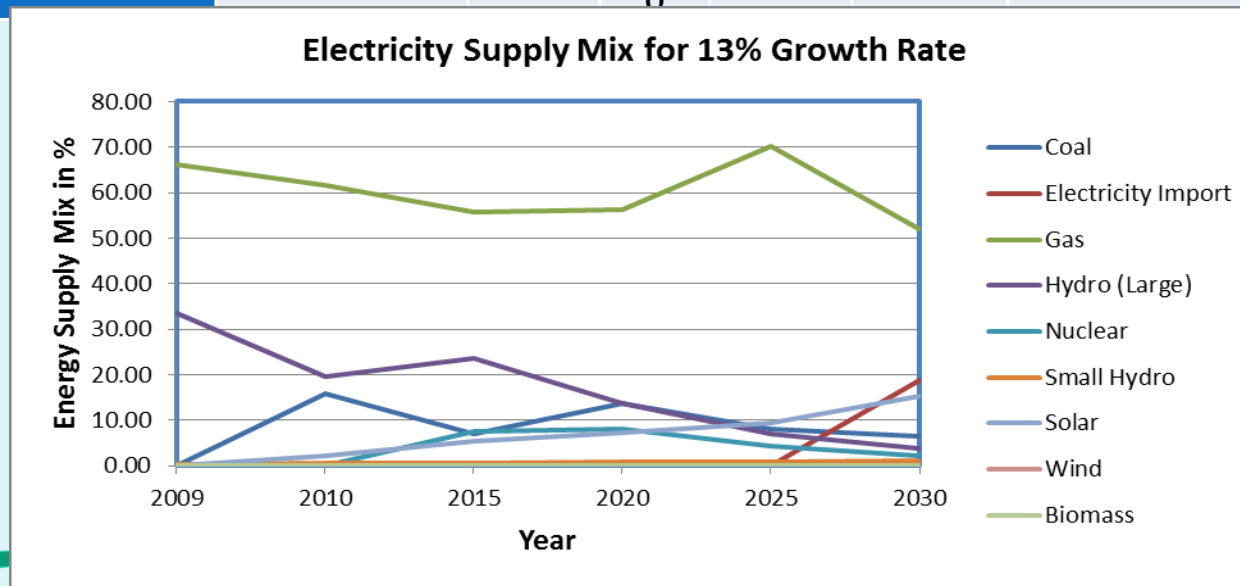
4. Electricity Supply Projections

... Cont'd



Table 3d: Electricity Supply Projections by Fuel Type: Optimistic II Scenario 13%

	2009 (Based Yr)	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 (Large)	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
Supply	5753	21238	47490	88698	171598	315158



4. Electricity Supply Projections

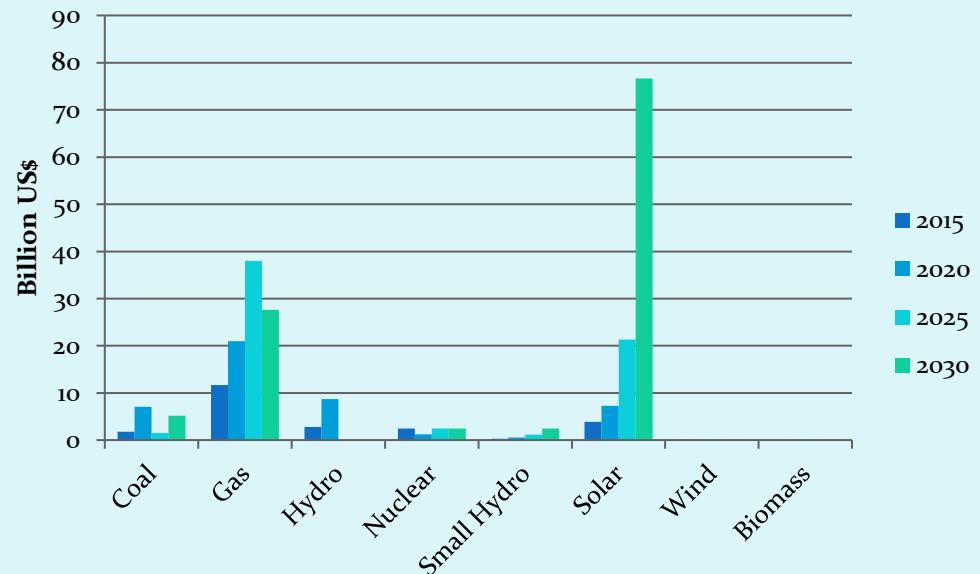
... Cont'd



Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Reference Scenario (7%)

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)



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

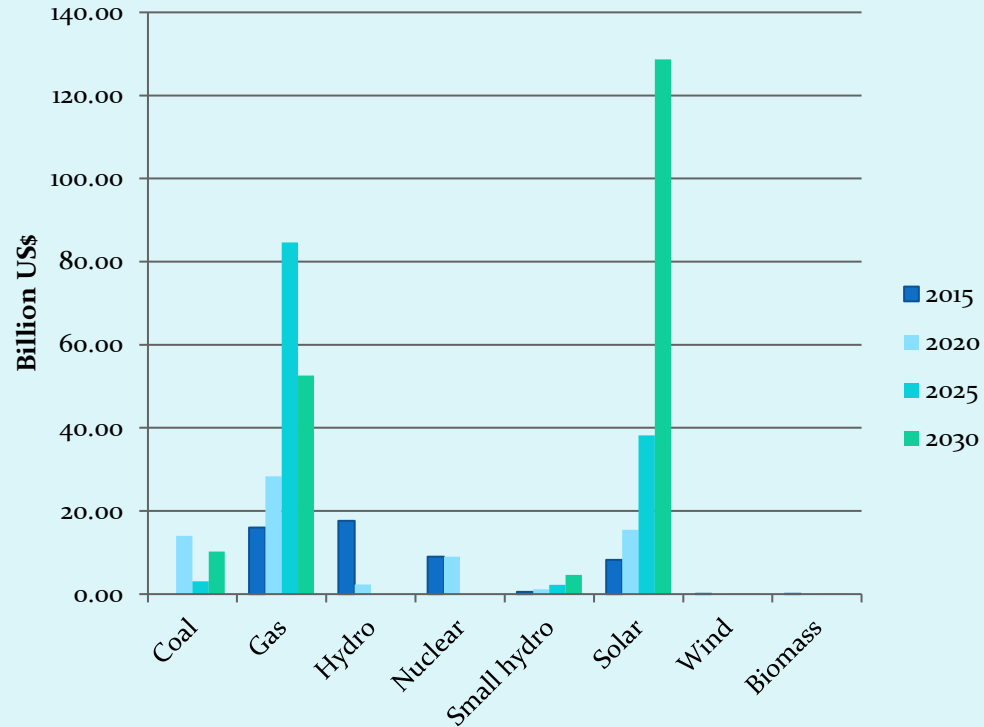
4. Electricity Supply Projections

... Cont'd



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)

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

5. Drivers of Renewable Energy in Nigeria



- Policy/Political will
- Availability of Renewable Energy Resources
- Imperative for Energy Security
- Climate Change
- Need for Diversification of Economy
- Job Creation Imperative
- Desire for Increased access to energy
- Available Matured Technology
- Availability of global cheap funds

6.

Conclusion

- In view of the finiteness of fossil fuels as source of energy, coupled with their negative effects on the ecosystem and global warming, as well as the national desire for diversification of the nation's energy supply mix to include renewable energy endowment of solar, hydro, biomass and wind backed by energy efficiency and conservation best practices; the use of renewable energy sources will continue to grow in driving sustainable development in the country.

**Thank you
and
God Bless**