



Roadmap for Nigeria's Energy Future*

By

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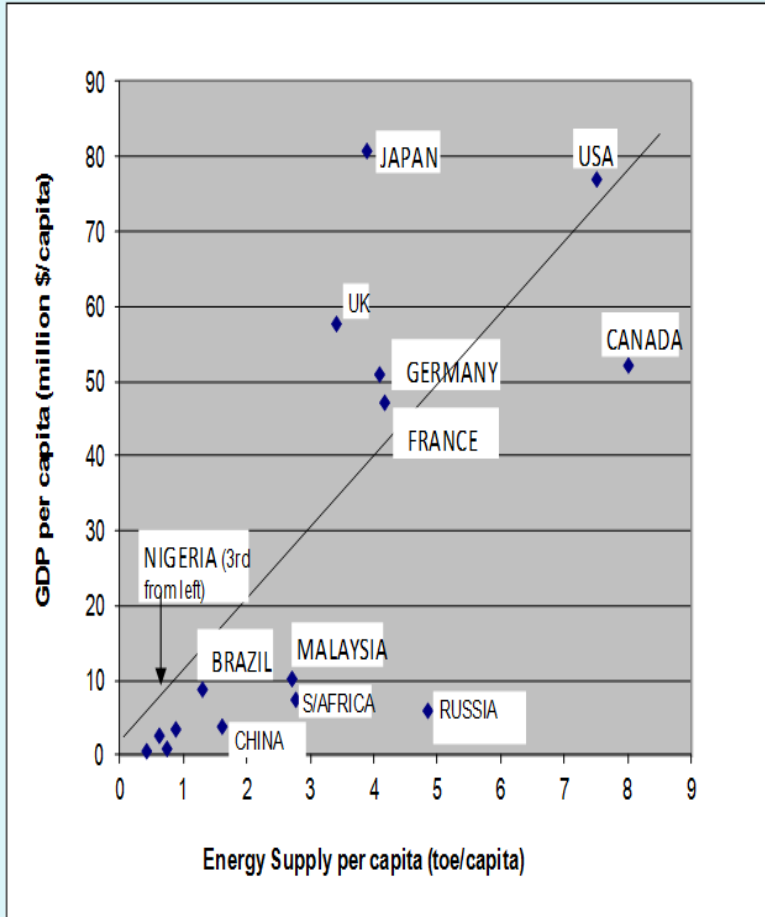
1. Introduction



- Energy, worldwide is one of the drivers of economic and social development.
- Nigeria therefore cannot be an exception.
- Fortunately, Nigeria is endowed with energy sources of fossil and renewable types that can be transformed into final energies of fuels, process heat and electricity essential for industrialization, economic and social development as well as improved standard of living of its citizens.

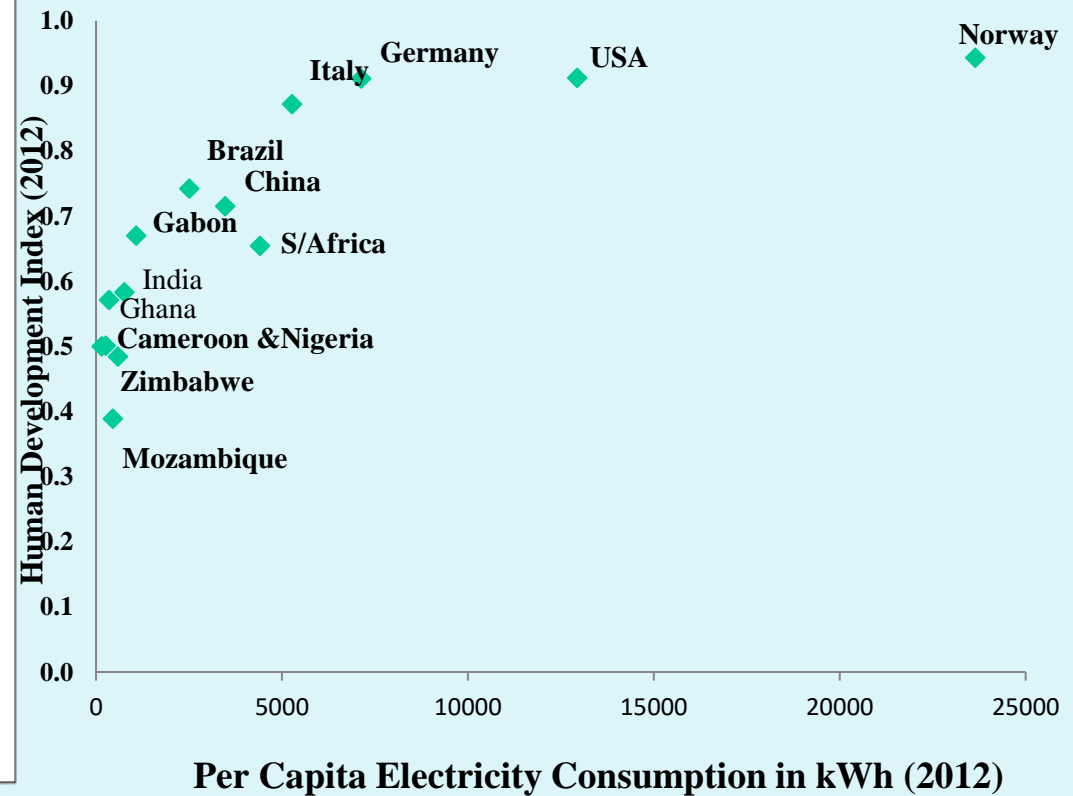
1. Introduction

Cont'd...



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

Relationship of HDI and Per Capita Electricity Consumption



Source: Human Development Report 2014 and IEA Key Energy Statistics 20

2. Energy Supply: Where Are We?



a) Fossil Energy Resources and Nuclear Energy Sources

S/N	Resources	Reserves	Production	Domestic Utilization
1	Crude Oil	37.1 billion barrels	0.774 billion barrels (2015)	0.098 billion barrels @ 4.9% capacity utilization (2015)
2	Natural Gas	182.3 Tscf	2.9 Tscf (2015)	88% : Utilized(2015) 12% : flared (2015)
3	Coal	2.7 billion tonnes	0	Negligible
4	Tar Sands	31 billion barrels of oil equivalent	0	18.25 million barrels (2014)
5	Nuclear	Yet to be quantified	0	30kW experimental nuclear reactor

Source: OPEC (2015)

2. Energy Supply: Where Are We?

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)

2.

Energy Supply: Where Are We?



Nigeria's Energy Supply and The Economy

S/N	ITEMS	2011	2012	2014	2016
1	Electricity Consumption (billion kWh)	24.5	26.2	25.5	30
		(619)*		(657*)	
		(20,407)**		(21963)**	
2	Total Energy Supply per Capita (Kgoe/cap)	730	790	760	
		(670)*		(670*)	
		(1880)**		(1890)**	
3	Electricity Consumption (kWh/Capita)	151	155	144	161.3
		(592)*		568*	
		(2933)**		3030**	
4	GDP/Capita (US\$/Capita)	1471	1513	2550	1359
		(1281)*		(1923*)	
		(7520)**		(10,058)**	
5	Energy Intensity (kgoe/US\$)	0.71	0.75	0.3	0.89
		(0.550)*		(0.35*)	
		(0.250)**		(0.19*)	
6	GDP Growth Rate (%)	7.4	6.6	6.3	-1.51

Sources: Transmission Company of Nigeria (TCN) 2011-2015

*Africa Average - IEA (2013 -2016)

**World Average - IEA (2013 -2016)

3. Energy Supply: Where Do we Want to Be?



- The Energy Commission of Nigeria (ECN), which I superintend, was established in 1979 by law, amended in 1988 and 1989.
- The law and its amendments is now encapsulated in the ECN Act, CAP E10, LFN 2004.
- 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.

3. Energy Supply: Where Do we Want to Be?



- So far, Ghana and Nigeria are the two ECOWAS member States that have successfully established Energy Commissions.
- The primary legal mandate of the ECN is to produce strategic plans and co-ordinate national policies on energy in all its ramifications.
- One of the first activities the Commission embarked on, upon commencement of operation was the development of a national energy policy instrument upon which national strategic energy plans would be derived from; and also upon which coordination would revolve.

3. Energy Supply: Where Do we Want to Be? Cont'd



- The development of a National Energy Policy was therefore embarked under the arrow-head of Energy Commission between 1993 and 2003 with due consultation with stakeholders.
- It was approved by Federal Executive Council (FEC) in 2003 and reviewed in 2013. NEP has the following objectives:
 - (i) To ensure the development of the nation's energy resources, with diversified energy resources option for the achievement of national energy security and an efficient energy delivery system with an optimal energy resource mix;
 - (ii) To guarantee increased contribution of energy productive activities to national income.
 - (iii) To guarantee and efficient and cost effective consumption pattern of energy resources.

3. Energy Supply: Where Do we Want to Be? Cont'd



- (iii) To guarantee adequate, reliable and sustainable supply of energy at appropriate costs and in an environmentally friendly manner, to the various sectors of the economy, for national development.
- (v) To accelerate the process of acquisition and diffusion of technology and managerial expertise in the energy sector and indigenous participation in energy sector industries, for stability and self-reliance.
- (vi) To promote increase investments and development of the energy sector industries with private sector leadership.
- (vii) To ensure a comprehensive, integrated and well-informed energy sector plans and programmes for effective development.

3. Energy Supply: Where Do we Want to Be? Cont'd



- (viii) To foster international co-operation in energy trade and projects development in both the African region and the world at large.
- (ix) To successfully use the nation's abundant energy resources to promote international co-operation
- (x) To promote research and development in, and adoption of, sustainable low carbon and clean energy technologies to mitigate environmental pollution and climate change.
- (xi) To promote gender sensitivity and special attention to rural energy needs.
- (xii) To promote efficiency, conservation and carbon management best practices in the nation's energy supply chain.
- (xiii) To ensure comprehensive and up-to-date availability of energy sector data and information
- (xiv) To ensure effective coordination of national energy planning, programmes and policy implementation.

3. Energy Supply: Where Do we Want to Be? Cont'd



Rise of the MINTs (\$ trillions)



Source: World Bank, Goldman Sachs

Nigeria's Ranking in the World based on GDP

3. Energy Supply: : Where Do We Want to Be? ... Cont'd



- It may be recalled that the Nation envisioned 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.
- STI roadmap 2030 recently approved by FEC quoted Pricewater house Cooper (PWC) 2015 report as having predicted that Nigeria ranked 20th in 2014 is to be 16th by 2030 and 9th by 2050.
- Whichever the case may be, this upwards movement requires adequate, reliable and cost effective supply of electricity, fuels and process heat in the economy.

3. Energy Supply: : Where Do We Want to Be? ... Cont'd



- Energy supply must however be done in a responsible and sustainable manner i.e the energy trilemma must be faced squarely - energy security, energy equity and environmental sustainability
- A study therefore 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. The model has the economy, demography, life style and envisaged path for of industrialization as inputs, amongst others

3. Energy Supply: : Where Do We Want to Be? ... Cont'd



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 and end gas flaring by 2020.
- 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. Energy Supply: : Where Do We Want to Be? ... Cont'd



Projected Total Energy 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)

* Punch 29th June 2014, pg 25

3. Energy Supply: : Where Do We Want to Be? ... Cont'd



b) Coal/Lignite, 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



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. Energy Supply: : Where Do We Want to Be? ... Cont'd

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

3. Energy Supply: : Where Do We Want to Be? ... 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

3. Energy Supply: : Where Do We Want to Be? ... Cont'd

d) Electricity

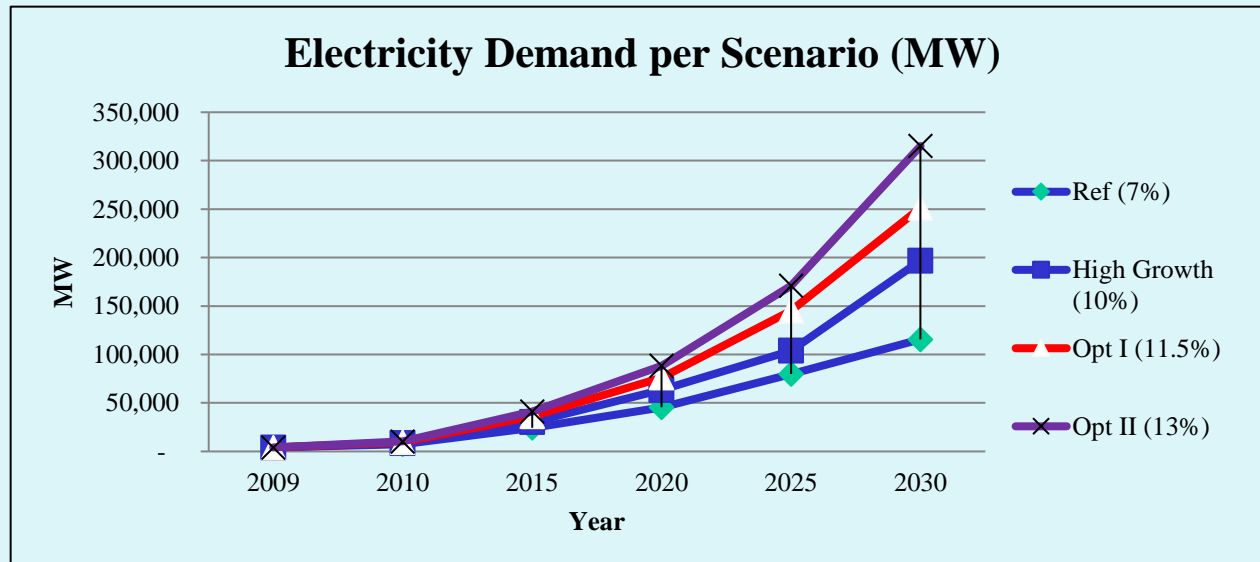
- That the electricity sub-sector contributes immensely to a double digit growth of the economy such that Nigeria becomes within the 20 largest economy in the world by 2020 or thereabout, through active private sector participation with high local contents and in an environmentally friendly manner. Projected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

3. Energy Supply: : Where Do We Want to Be? ... Cont'd

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

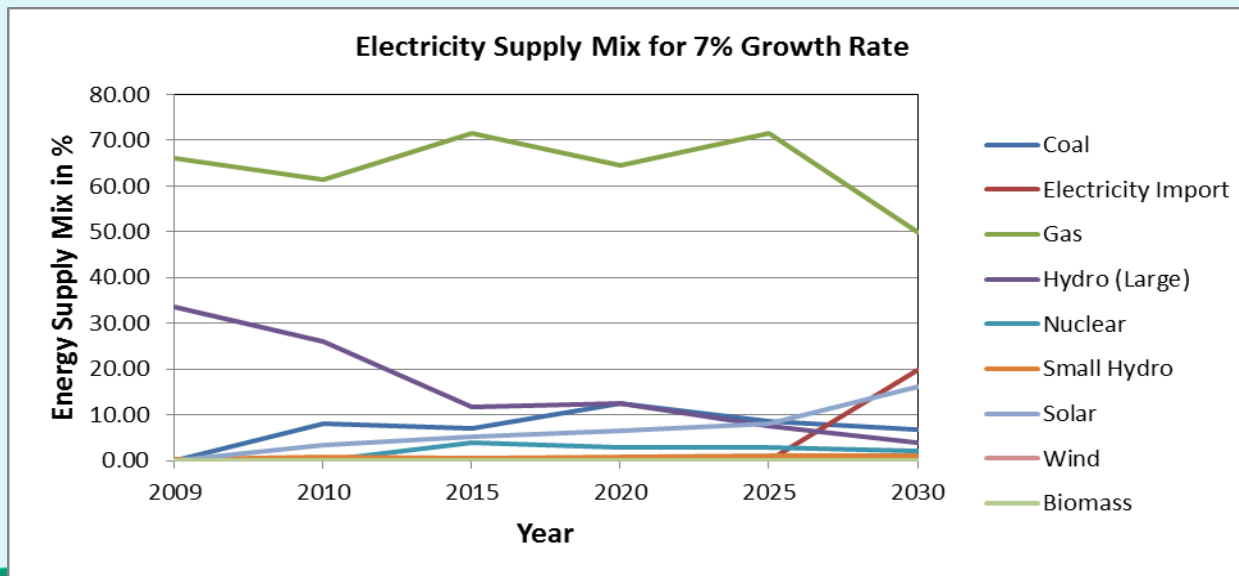


Source: ECN, 2012

3. Energy Supply: : Where Do We Want to Be? ... Cont'd

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

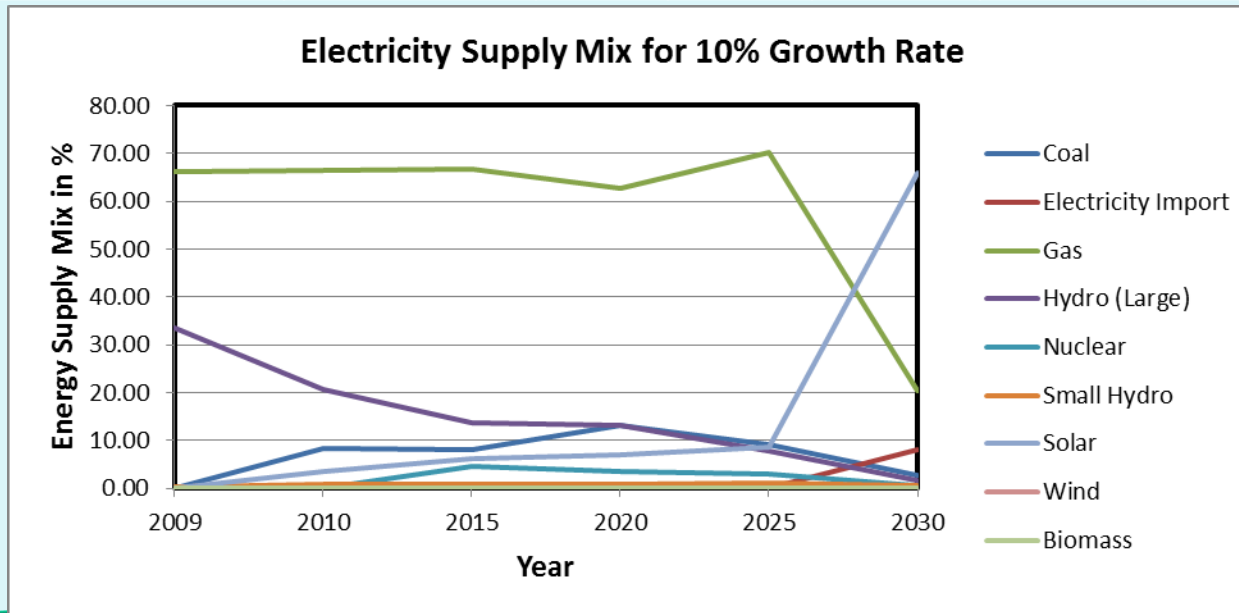
	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	609	1850	6527	7545	10984
Electricity Import	0	0	0	0	0	31948
Gas	3803	4572	18679	33711	61891	80560
Hydro (Large)	1930	1930	3043	6533	6533	6533
Nuclear	0	0	1000	1500	2500	3500
Small Hydro	20	60	172	409	894	1886
Solar	0	260	1369	3455	7000	25917
Wind	0	10	19	22	25	29
Biomass	0	0	3	16	35	54
Supply	5753	7440	26092	52174	86422	161411



3. Energy Supply: : Where Do We Want to Be? ... 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

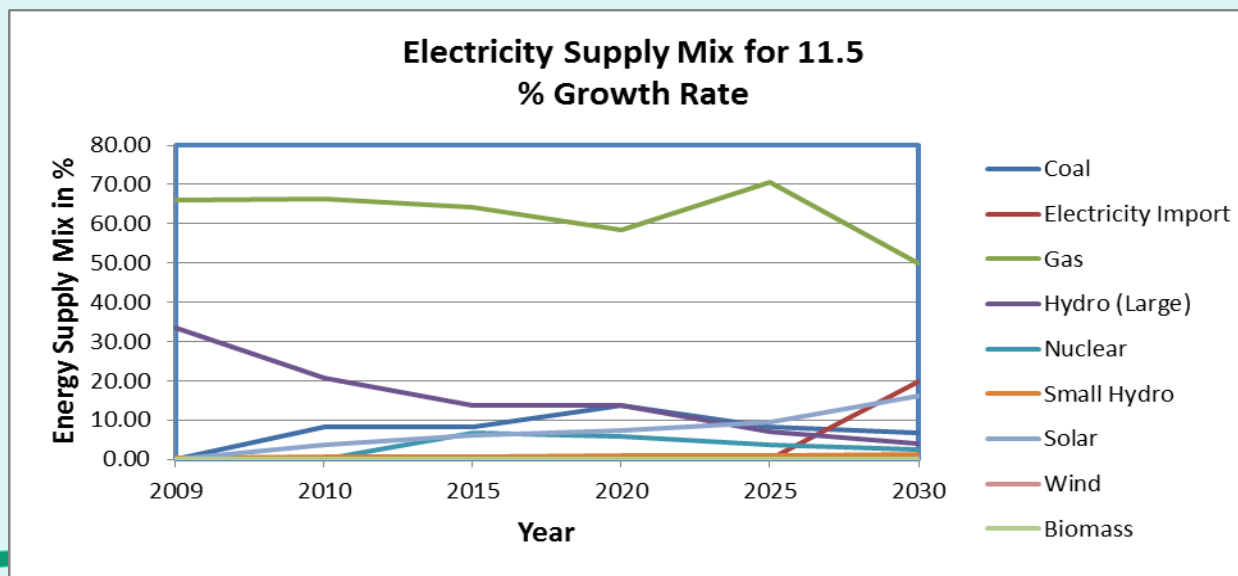


3. Energy Supply: : Where Do We Want to Be? ... Cont'd



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

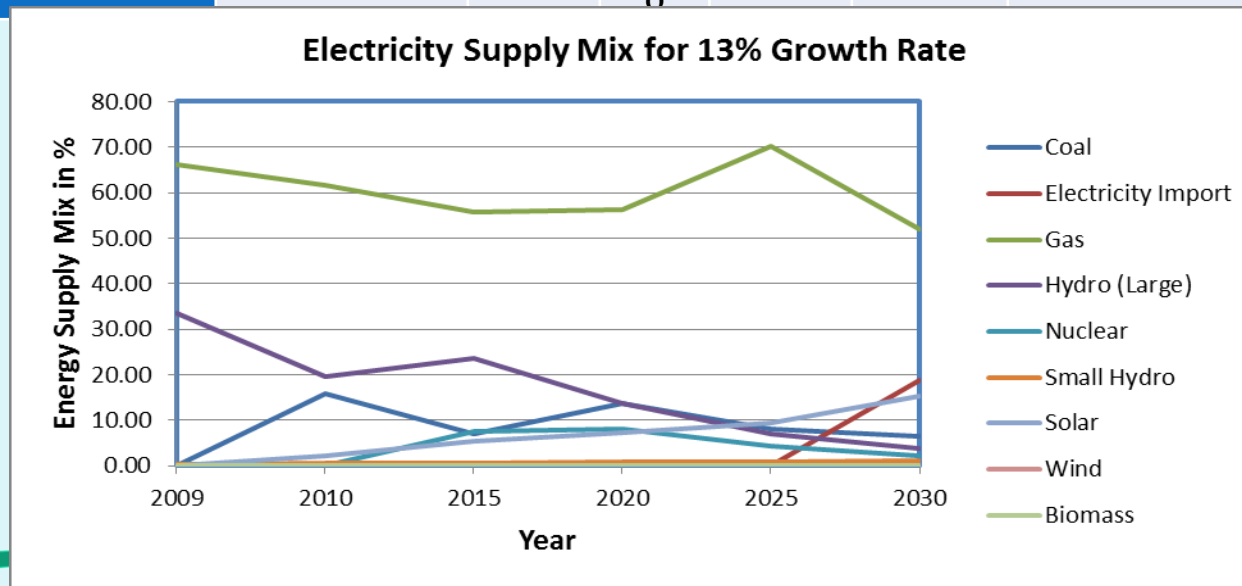


3. Energy Supply: : Where Do We Want to Be? ... Cont'd



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

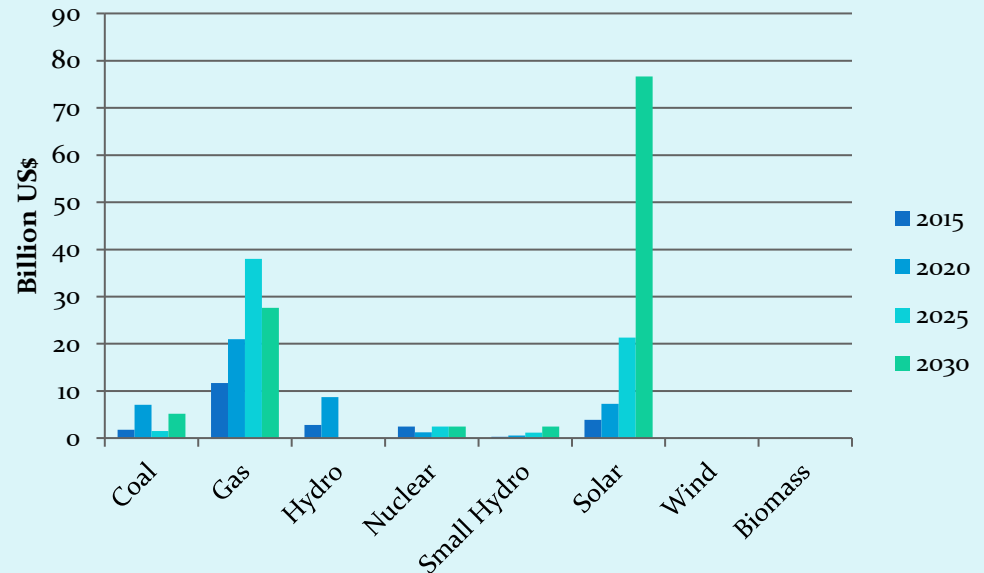
	2009 (Based Yr)	2010	2015	2020	2025	2030
Coal	0	3353	3353	12122	14011	20399
Electricity Import	0	0	0	0	0	59333
Gas	3803	13110	26426	49996	120512	164307
Hydro (Large)	1930	4157	11207	12132	12132	12132
Nuclear	0	0	3600	7200	7200	7200
Small Hydro	20	105	320	760	1660	3502
Solar	0	490	2543	6417	15970	48132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



3. Energy Supply: : Where Do We Want to Be? ... Cont'd

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



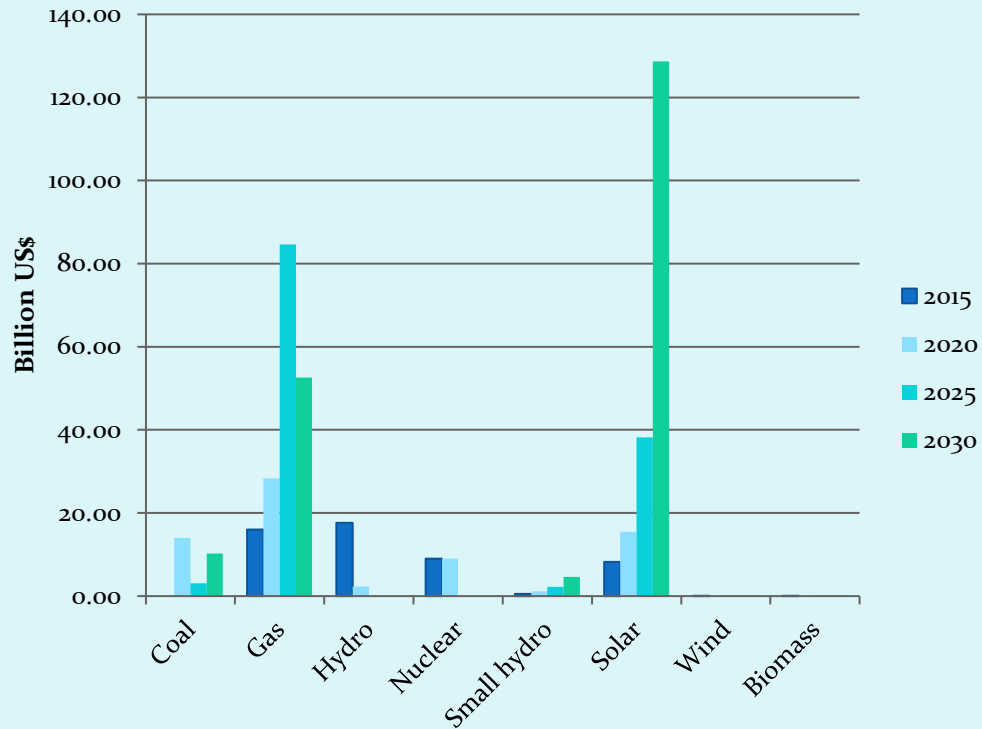
Source: ECN

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

3. Energy Supply: : Where Do We Want to Be? ... 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



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

Source: ECN

4. Conclusion



- Nigeria's energy future must be such that supply is reliable, adequate, affordable and environmentally sustainable and the sector driven by the private sector.
- How we get there and at what speed will depend upon the political will exhibited by Governments of the country towards the vision.

**Thank you
and
God Bless**