Achieving Sustainable Energy for All in Nigeria: What Does It Take? *

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1. Introduction

- **I am indeed honoured to be invited by the Nigerian National Committee of the World Energy Council (WEC), to deliver a paper on "Sustainable Energy for ALL in Nigeria: What Does it Takes?" at the One-Day Workshop on Energy Access for Sustainable Development.**

- **Energy is central to sustainable development and poverty reduction efforts. It affects all aspects of development -- social, economic, and environmental -- including livelihoods, access to water, agricultural productivity, health, transportation, industry, education, and gender-related issues.**

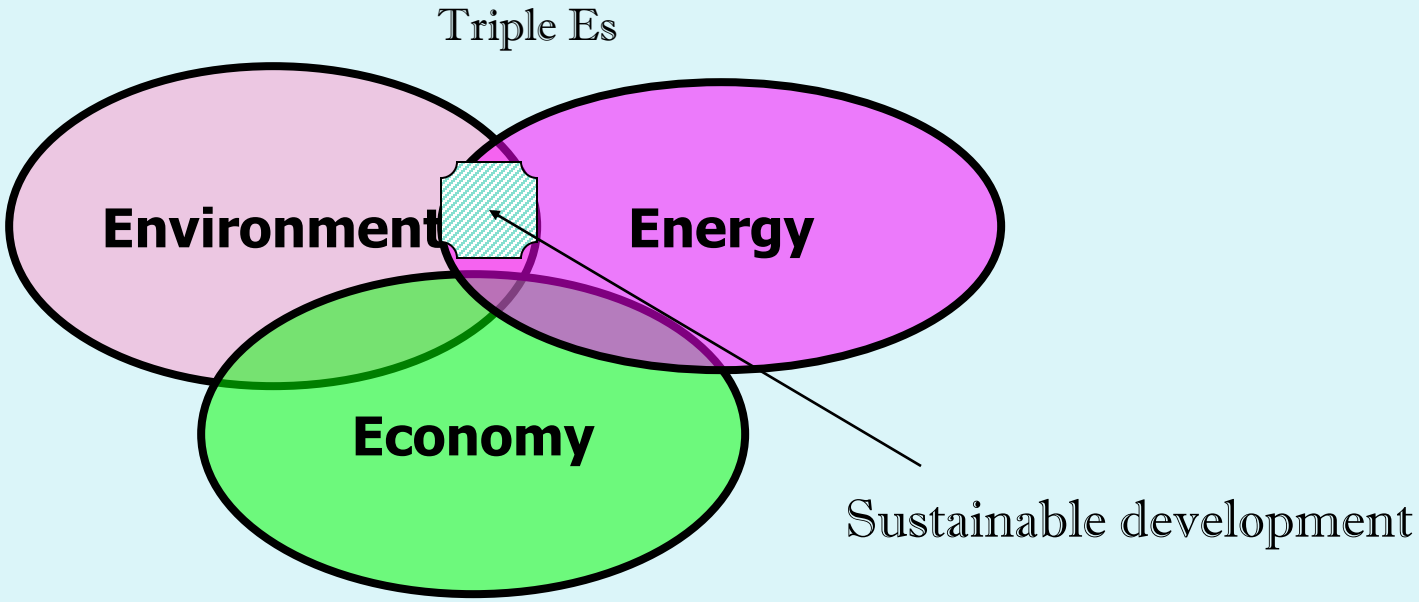
- **Indeed, access to adequate, reliable, efficient and affordable energy services is the key to achieving economic growth and development.**

- **Therefore, energy is the main engine for the actualization of the nation's sustainable social, economic and industrial growth envisioned by 2020.**

- **Nigeria is naturally well positioned and endowed with all energy resources that if properly harnessed would make energy available for the needed development.**

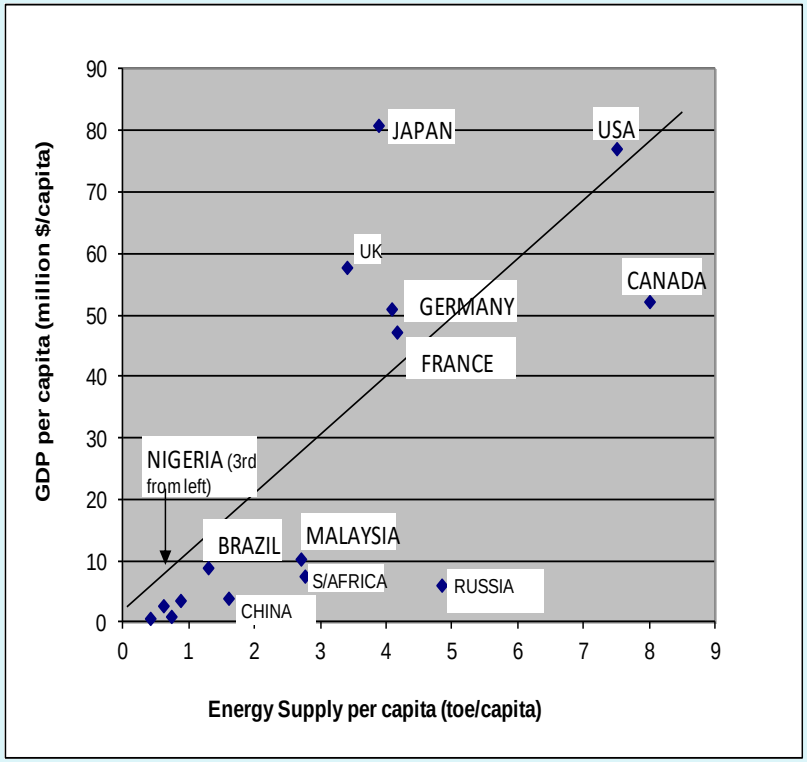
1. Introduction Cont'd…

A nexus exists between energy, economic growth and national development. Hence, in producing and consuming energy (electricity) for the growth of the national economy, it must be done in a responsible and sustainable manner, i.e. a manner that not only meets, the needs of the present but also guarantees the future generations to meet their needs.

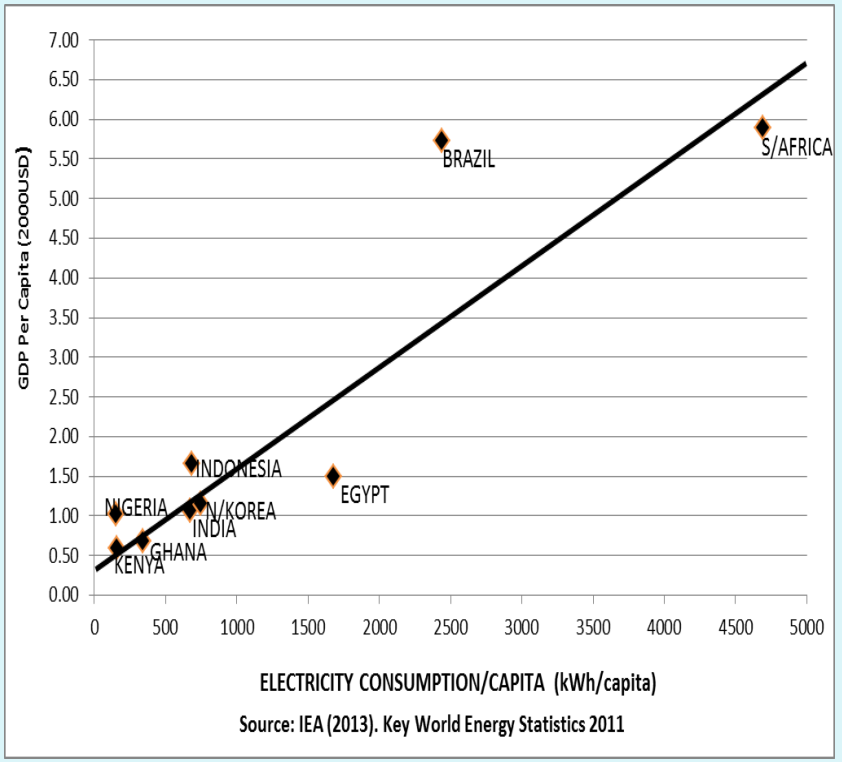


1. Introduction Cont'd….

- The relationship between economic development of nations, which is imperative to human development, and energy can be graphically illustrated as below:-

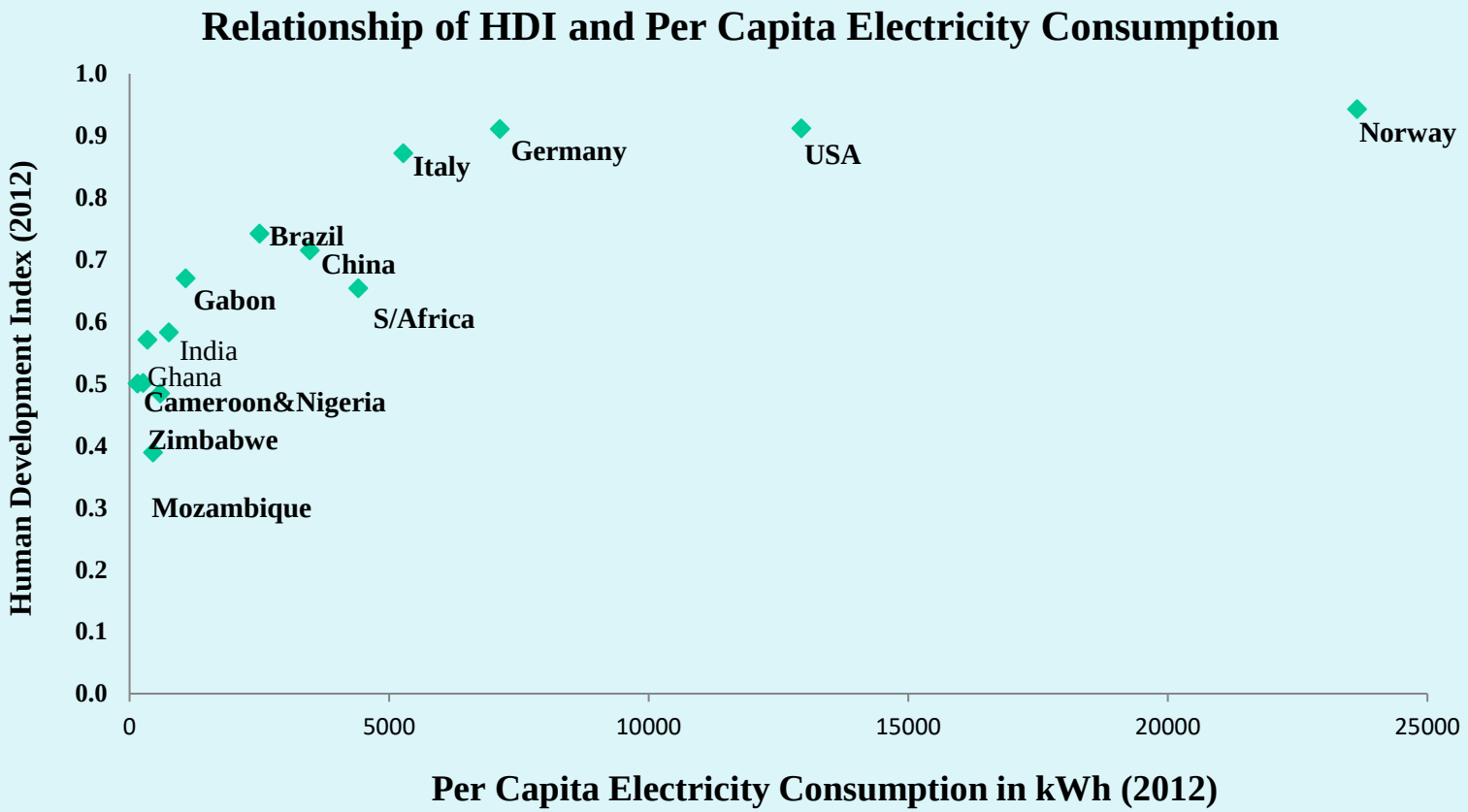


Graphical representation of the relationship between Energy and the Economy (IEA, 2010)



Effect of Electrical Energy Consumption on Economic Development of Nations.

1. Introduction Cont'd…



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

3. Introduction…Contd..

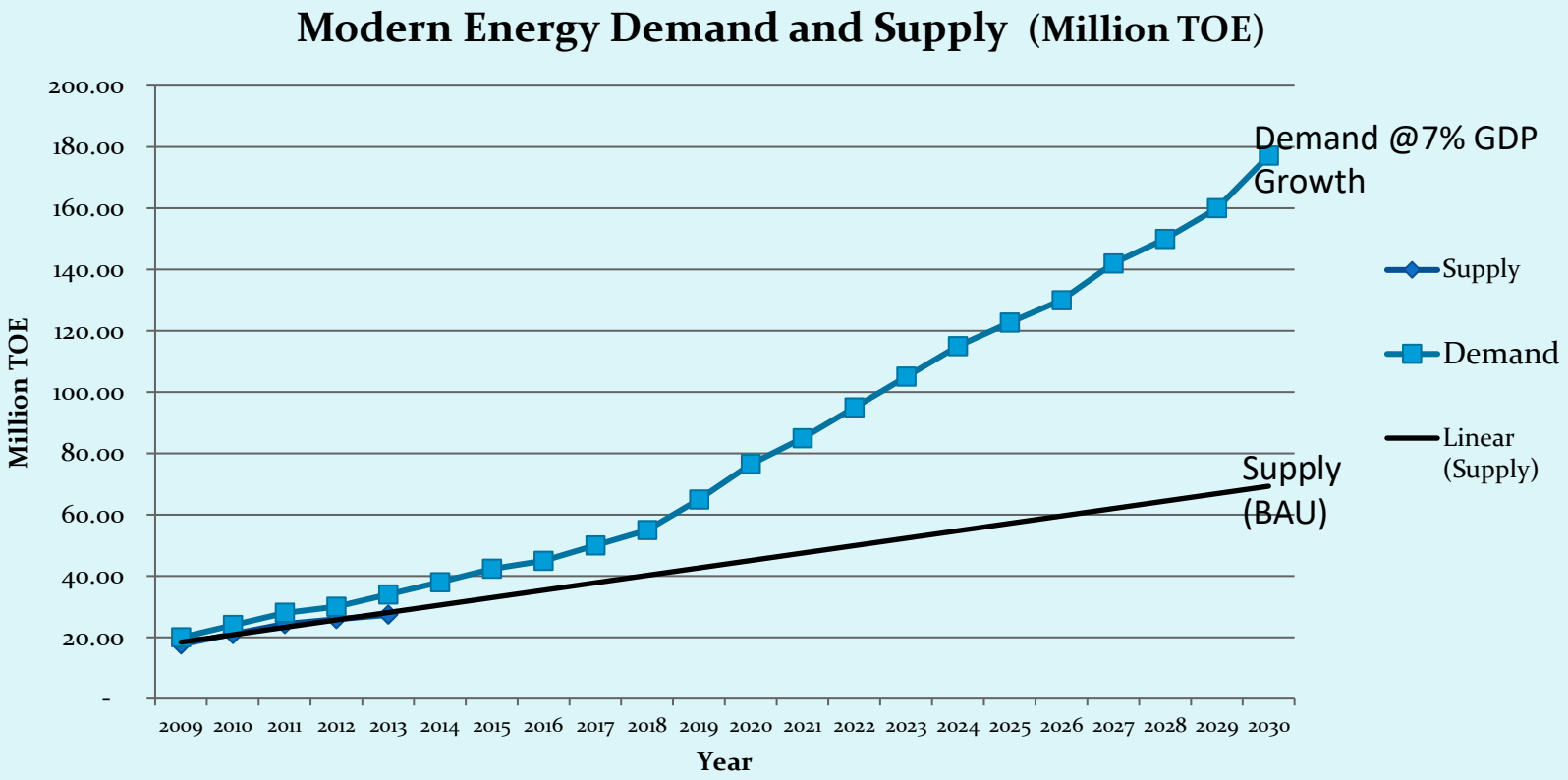
Nigeria's Energy Supply and The Economy

S/N	ITEMS	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
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	25.02	27.7 (619)* (20,407)**	29.6
2,	Energy Consumption per Capita (kgoe/Capita)	151.3	125.5	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)	174.6	176.4	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$/Capita)	620.7	658.0	826.3 (2314)* (8,492)**	1030.3	1223.5	1286.3 (2540)* (9550)**	1,106.8	1440.7	1470.6 (1281)* (7520)**	1513.4
5.	Energy Intensity (kgoe/ US$)	0.244	0,191	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)***

1. Introduction Cont'd…

- Hence, present and future prosperity of Nigerian will be challenged by increasing modern energy demand and supply.



Source: ECN (2015)

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	3.2Tscf	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 & Infrastructure in Nigeria

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/m²/day 6.5kWh/m²/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 only 8.5% is cultivated

Source: Renewable Energy Master Plan (REMP)

An Overview of the SE4ALL Initiative

- In September 2011, the UN Secretary General announced his Sustainable Energy for All (SE4ALL) initiative with three interlinked objectives of:
  - ensuring UNIVERSAL ACCESS to modern energy services;
  - doubling the global rate of improvement in ENERGY EFFICIENCY; and
  - doubling the share of RENEWABLE ENERGY in the global energy mix by the year 2030.
- This initiative was launched in Nigeria by Mr President in 23rd August 2012 at Aso Villa.

Overview of SE4All: Action Areas

Sectoral Action Areas

- A Modern cooking appliances and fuels
- B Distributed electricity solutions
- C Grid infrastructure and supply efficiency
- D Large scale renewable power
- E Industrial and agricultural processes
- F Transportation
- G Buildings and appliances

Enabling Action Areas

- W Energy planning and policies
- X Business model and technology innovation
- Y Finance and risk management
- Z Capacity building and knowledge sharing

4. SE4ALL: What It Takes

- The Nation's vision is to be amongst the 20 large economies in the world by 2020, is a vision for Sustainable Energy for ALL; because, achieving that vision 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 to achieve sustainable energy for all. The study was done under the following scenarios and assumptions:

4. SE4ALL: What It Takes… Cont'd…

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. SE4ALL: What It Takes …..Cont'd…

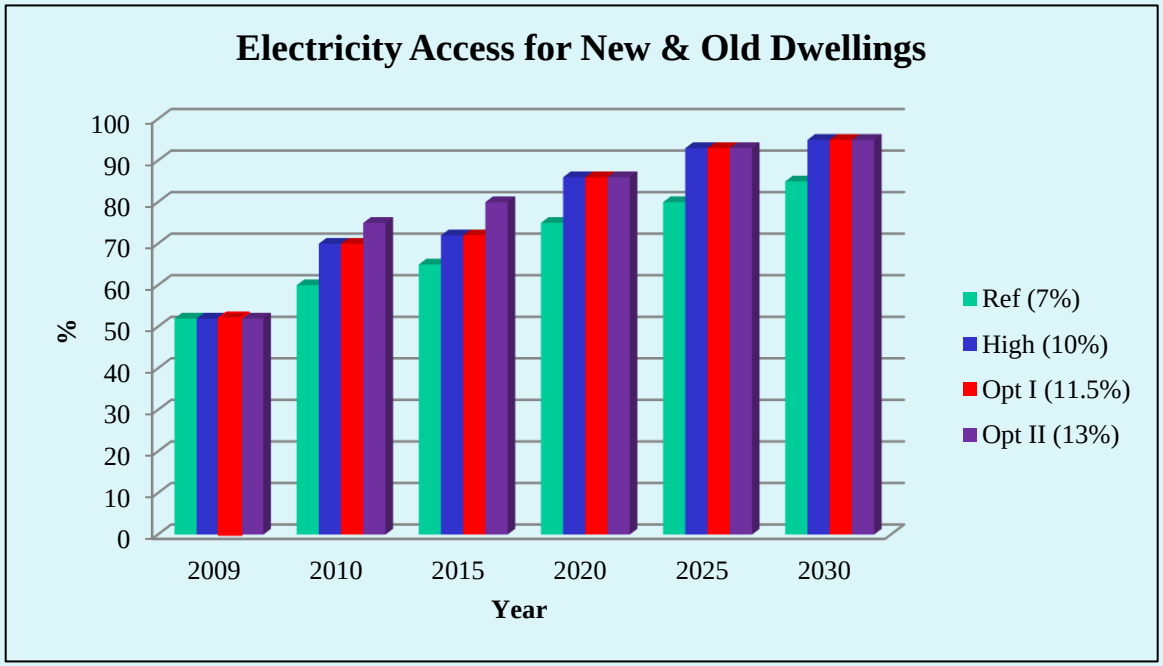
- **Optimistic Growth Scenario I**
  - GDP grows by an average of 11.5% p.a.
  - Manufacturing to contribute 22% to GDP by 2030 from 4% in 2010
  - Nigeria transits from an agrarian to an industrializing economy

- **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. SE4ALL: What It Takes Cont'd…

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



Source: ECN (2010)

Projected Electricity Access

4. SE4ALL: What It Takes ….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
- 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

4. SE4ALL: What It Takes… 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
2012*									120	
2014*									250	
2015	14460.0	19510.0	3788.0	7039.0	2301.9	3651.0	1800.0	3380.0	1107.0	1871.2
2016*									500	
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

4. SE4ALL: What It Takes ....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

4. SE4ALL: What It Takes ….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

4. SE4ALL: What It Takes ….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. SE4ALL: What It Takes …..Cont'd…

d) Power

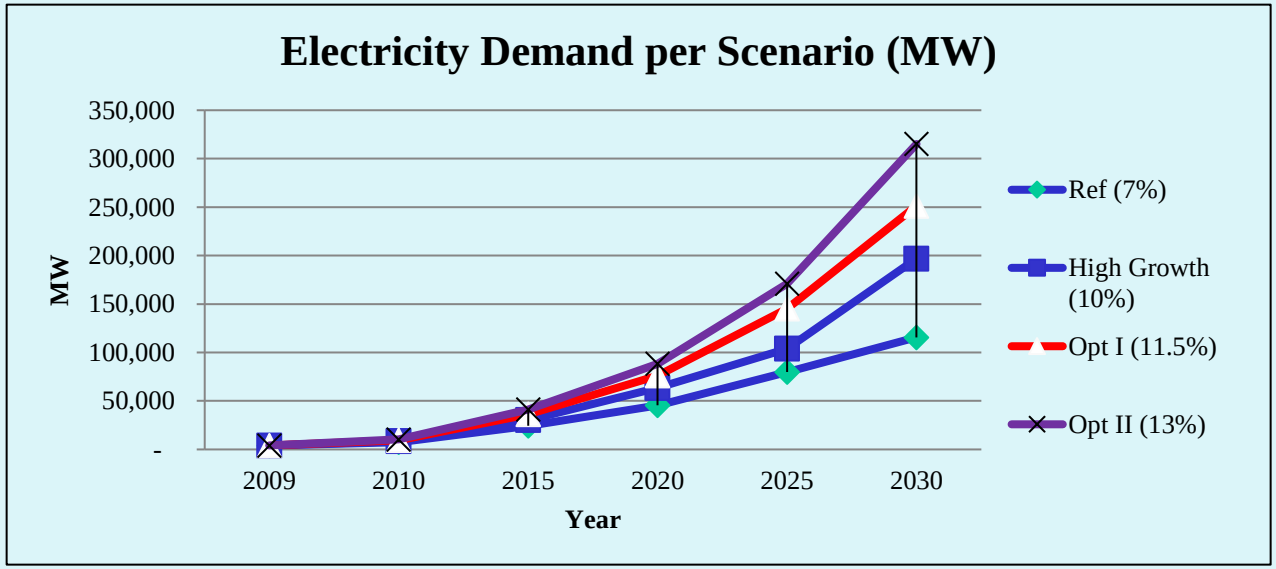
- That power contributes immensely to a double digit growth of the economy such that Nigeria becomes within the 20 largest economy in the world by 2020 or thereabout, through active private sector participation with high local contents and in an environmentally friendly manner (SE4ALL). Projected power demand and supply for various scenarios from MAED and MESSAGE studies conducted are as shown in the following tables:

4. SE4ALL: What It Takes…. 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

4. SE4ALL: What It Takes …Cont'd…

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)

4. SE4ALL: What It Takes …Cont'd…

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)

4. SE4ALL: What It Takes ….Cont'd…

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)

4. SE4ALL: What It Takes ….Cont'd…

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

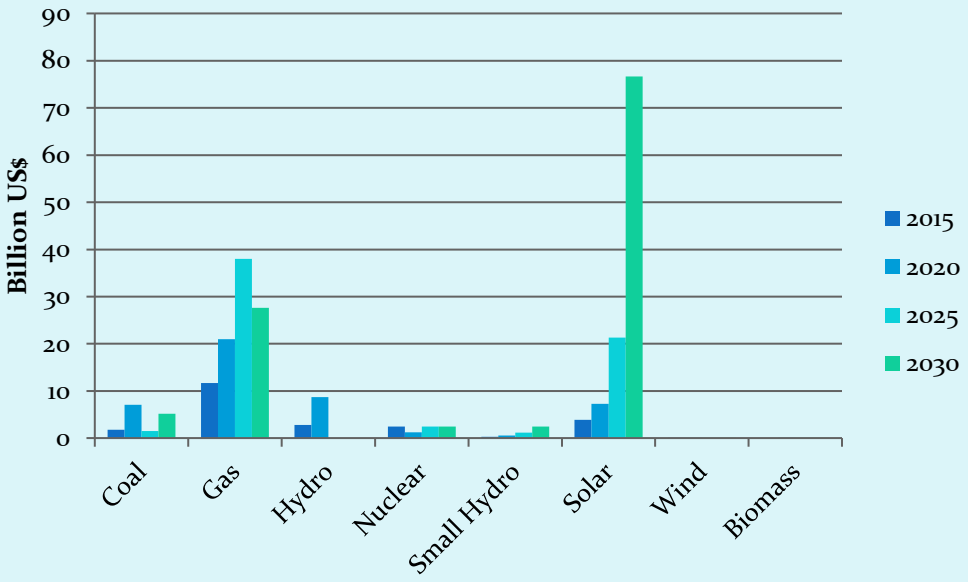
Source: ECN (2010)

4. SE4ALL: What It Takes ….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 (2010)

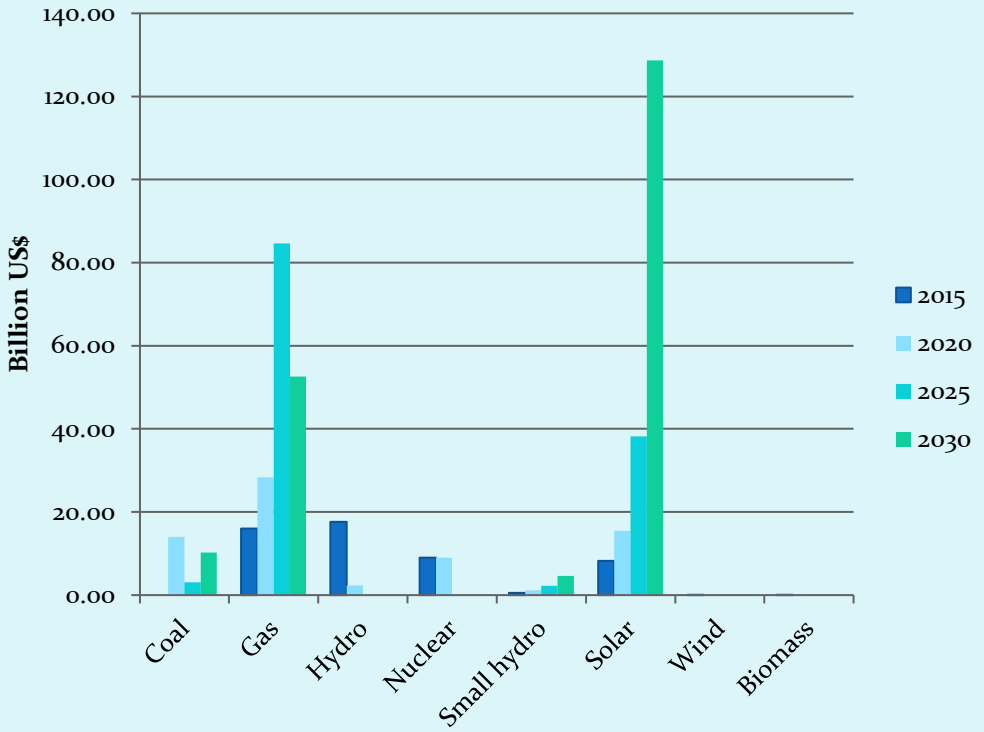


Capital Cost of Additional Generating Capacity by Technology in Billion US Dollars for the Reference Scenario

4. SE4ALL: What It Takes ….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%)

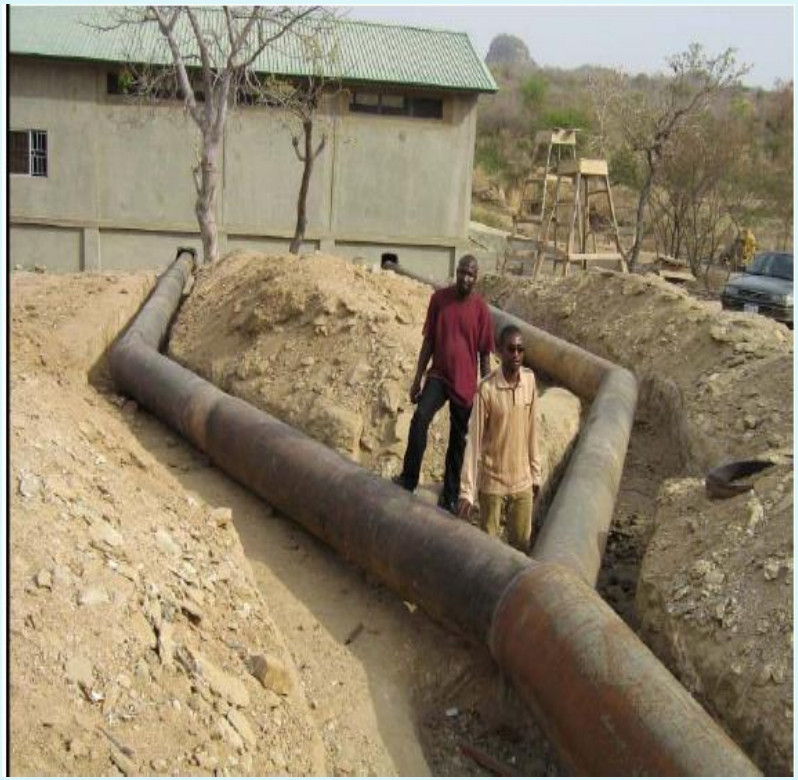
Source: ECN (2010)

5. The Paths to SE4ALL in Nigeria

a) Hydropower

Nigeria with a hydropower potential of about 15,000MW has about 2000MW only exploited. A large unexploited potential therefore exists that needs to be developed fully. For example, the Zungeru, the Mambila, the Gurara II, the Dadin Kowa dam, the Tiga Dam, the Kasimbila and many other small hydro power sites in addition to cascading existing sites. It is expected that about 14,000MW of hydro should be available by 2020 if our dream is to come true.

5. The Paths to SE4ALL in Nigeria .. Cont'd…



Penstock bifurcation into the 150 kW power house at Waya Dam, Bauchi State

5. The Paths to SE4ALL in Nigeria .. Cont'd…

b) **Solar Energy:**

Solar energy has the greatest potential to contribute enormous amount of low carbon energy in Nigeria through solar PV and solar thermal process. It may be transformed directly into heat using solar collectors or directly to electricity using solar PV cells. It is estimated that about 6,000MW of solar electricity be put in place by 2020. however, only about 15MW of dispersed solar PV systems are on ground.

5. The Paths to SE4ALL in Nigeria..contd

Solar PV Systems

3kW solar PV mimi-grid in Talasse General Hospital, Balanga LGA, Gombe State (2013)

Solar PV powered Water Borehole in Abule Kajola, Akute, Ifo LGA, Ogun State (2013)

Solar PV Streetlight in Omiadio, Ido LGA, Oyo State (2013)

The Paths to SE4ALL in Nigeria .. Cont'd…

2.5 MW Solar PV, in Sal, Cape Verde
Commissioned October 1, 2010

5 MW Solar PV, in Praia, Cape Verde
Commissioned November 2, 2010

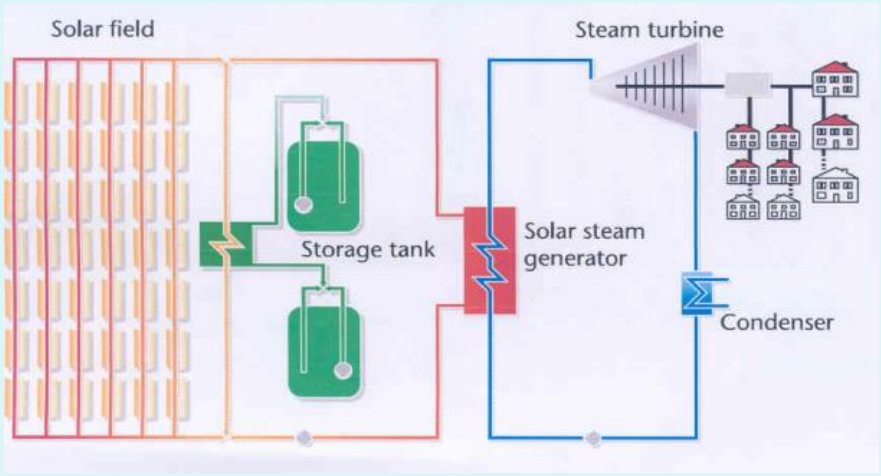
Source: ECREE (2011)

The Paths to SE4ALL in Nigeria .. Cont'd…

Solar Thermal Power Generation

Solar thermal Plant in Spain (Heliostat)

50 MW Solar thermal Plant in Spain (Parabolic)



Rankine Cycle

The Paths to SE4ALL in Nigeria .. Cont'd...

Solar Water Heater

Pilot Water Heater at UDUTH by SERC, Sokoto

Solar Water Heater developed by NCERD

The Paths to SE4ALL in Nigeria .. Cont'd…

c) Wind Energy

Nigeria's wind resource of 2-4m/s at 10m height is considered low for wind farm electricity generation using conventional wind generations. However, at higher heights greater wind speeds may be encountered, where reasonable electricity could be generated there from. It is envisioned that about 40MW of wind electricity would be needed by 2020. However, a 20MW wind farm is in place in Katsina state.

The Paths to SE4ALL in Nigeria .. Cont'd...

150MW Osario Wind Farm, Brazil

Harnessing Wind Energy for Electricity Generation in Brazil

600 MW Zanfaran Wind Farm in Egypt, along the Red Sea.

5kW aero generator in Sayya Gidan Gada, Sokoto State

Drag Type wind Turbine for Water Pumping

The Paths to SE4ALL in Nigeria .. Cont'd...

- Biomass/biogas/biofuel Cont'd...
  - Power generation from rice husk(5MW in Ebonyi state)
  - Biogas generation for heating & power generation
  - Municipal waste-to-power
  - Biofuels (ethanol &biodiesel) from Sugarcane, Jatropha, cassava & Lignocellulolistic feedstocks – use of E10 & B20 approved by FEC.
  - Fuelwood lots development
  - it is expected that about 30MW of biomass electricity be available in our electricity supply mix by 2020

The Paths to SE4ALL in Nigeria .. Cont'd...

d.) **Biomass Conversion Technologies:** Biomass refers to organic matter of non-fossil type

32 kW Gasification Plant in Abakaliki, Ebonyi State

The Paths to SE4ALL in Nigeria .. Cont'd...

Sludge

Biogas Digester

Power House

Generating Plant

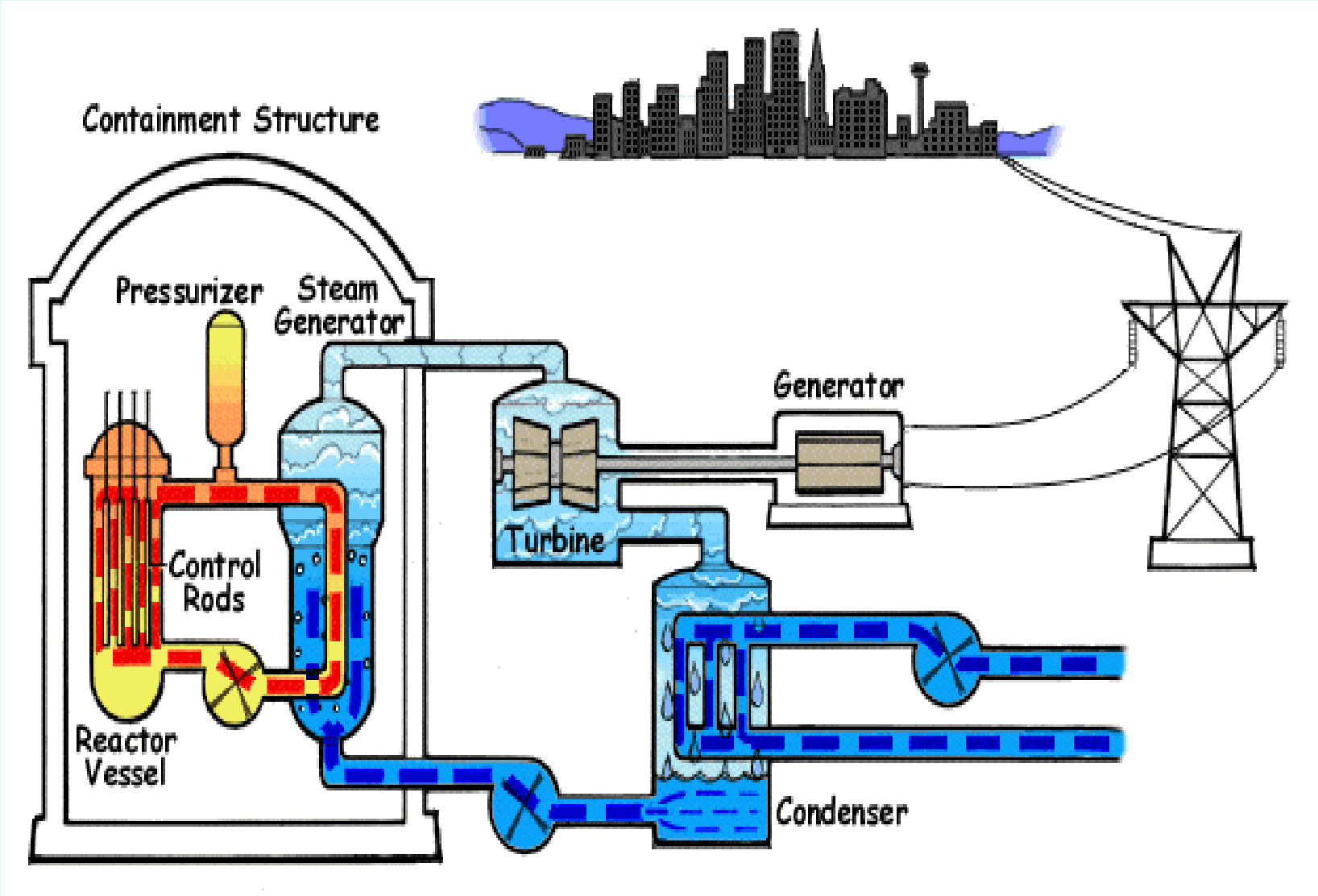
A 750 kW Plant for Biogas Electricity Generation in Germany

The Paths to SE4ALL in Nigeria .. Cont'd…

e) Nuclear Energy:

With an Atomic Energy Commission and a Nuclear Regulatory Authority, negotiations for nuclear power through IAEA in meeting the electricity needs of our country is on. It is expected that about 7000MW of nuclear power be provided in the economy by 2020. However, 1000MW only is being planned for the period by NAEC.

The Paths to SE4ALL in Nigeria .. Cont'd…



Typical PWR Power Plant System

The Paths to SE4ALL in Nigeria .. Cont'd...

f) Natural gas:

With the huge natural gas reserves in the offshore, onshore as well as potentials in the inland basins of Sokoto, Bida, Chad, Benue trough, Anambra etc., natural gas therefrom can be utilized for power generation and other industrial uses. It is expected that about 50,000MW capacity driven by natural gas be made available by 2020. However, about 9,000MW have been put in place.

The Paths to SE4ALL in Nigeria .. Cont'd…

414 MW Natural Gas Fired Power Plant, Geregu, Kogi State - NIPP

g) Clean Coal Technologies

The exploitation of coal, in the 14 states with coal potentials, for electricity generation, industrial heating and domestic applications using clean coal technologies would bring a lot of economic and environmental benefits. It is expected that about 12,000MW of clean coal power be made available by 2020. However, 1000MW is being planned by FMPower.

The Paths to SE4ALL in Nigeria .. Cont'd…

h) Energy Efficiency and Conservation

Demand for energy should always be kept at a minimum through:

- Use of energy audit to identify and rectify areas of energy wastage
- Labeling of appliances according to efficiency levels as a guide
- Use of efficient energy appliances like CFLs, LEDs, improved woodstove, efficient refrigerators and air-conditioners, electric motors etc.
- Use of combine cycle power plants to improve overall power efficiency (integrated solar combine cycle (ISCC) & (IGCC)

. It is expected that over 60% of the energy systems in use, be over the minimum energy efficient standard set by 2020

5The Paths to SE4ALL in Nigeria .. Cont'd…

Retrofitting ECN Building with LED Lamps to half the lighting load of the building (UNDP-GEF Energy Efficiency project)

5. The Paths to SE4ALL in Nigeria .. Cont'd

- Energy efficiency improvement is an important tool in achieving SE4ALL;
- Importation and/ or manufacturing of Energy-Efficient appliances and equipment could help the nation achieve sustainable environment;
- The technically feasible potential for energy efficiency improvement on the long term is a reduction of 50%-80% on specific energy consumption, which of course will reduce environmental pollution and extend the life span of our energy resources.

ENERGY EFFICIENCY AND CONSERVATION FOR SUSTAINABLE ENVIRONMENT

The Paths to SE4ALL in Nigeria .. Cont'd…

Improved firewood Clay cook stoves

The Paths to SE4ALL in Nigeria .. Cont'd…

Developmental Association for Renewable Energies (DARE) 80 % Efficient Wood Stove

6. Prospects and Challenges for Sustainable Energy for ALL in Nigeria

a) Prospects

i. There is high potential for growth in sustainable energy development because of the opening of the energy sector for private sector participation from the on going reforms, particularly the electricity subsector which is backed by law.
ii. No hindrance to repatriation of profits as an incentives to investors.
iii. Nigeria has a large local energy market as well as serves as a hub for the sub region.
iv. Some fiscal and financial incentives are available for sustainable energy development.
v. Pressure from the climate change adversaries enhances prospects for sustainable energy development in Nigeria.

b) Challenges

i. Inadequate local indigenous human and manufacturing capacities
ii. Inadequate incentives
iii. High initial investment cost for sustainable energy technologies
iv. Access to finance

7. Conclusion

- Nigeria is endowed with fossil and renewable energy sources. Crude oil and natural gas are being fully exploited now, and contribute over 70% of the Nation's foreign exchange earnings as well as major contributor to GDP. While crude oil production stands about 2mb/d, supply of petroleum products are, however , mainly from imports due to very low capacity utilisation of the domestic refineries. With current reserves and production rates, crude oil and natural gas maybe sustained for 52 years and 61 years, respectively. Coal deposits are sparingly being exploited.
- In view of the finiteness of fossil fuels coupled with their negative effects on the ecosystem and climate change, diversification of the nation's energy supply mix to include renewable energy endowment of solar, hydro, biomass and wind as well as nuclear energy backed by energy efficiency and conservation best practices becomes imperative for driving sustainable development in the country.
- Income derived from depletable fossil energy resources should be invested to develop the renewable energy endowment and nuclear as well as best practices in energy efficiency and conservation to enhance energy security, energy equity and environmental benefits.

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Thank you
and
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