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WALTER G. OLLOR

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ABOUT THE CONTRIBUTORS

Walter G. Ollor is Professor of Banking and Finance and Dean College of Business and Management Studies, Igbinedion University, Okada. He holds the Ph.D (Econs.) from Iowa State University, Ames Iowa, USA.

S.T. Wara is Professor of Engineering and Dean, Abdusalami Abubakar College of Engineering, Igbinedion University, Okada. He holds the Ph.D (Electrical Engineering) from the University of Benin, Benin City.

O.B.C. Nwolise is Professor of Political Science and Dean, College of Arts and Social Sciences, Igbinedion University, Okada. He holds the Ph.D (Political Science) from the University of Ibadan.

CONTENTS

Energy Management: Nigerian Scenarios

S. T. WARA, Ph.D
FIET, FNSE, MIASTED, MSAEE, R.ENG
Igbinedion University, Okada

KEYWORDS:
Nigeria, Economy, Generation, Consumption,
Energy Management, Environmental Development

ABSTRACT

Nigeria proposes to be among the top twenty (20) economies of the world by the year 2020. This proposal can be highly influenced by the effectual harnessing, appropriation, distribution and management of the nation's energy resources (fossil fuel and renewable), and strict implementation of international energy and environment laws. This paper outlines the Nation's prospective energy resources, energy production capabilities, consumption, export capabilities, environmental impact and laws. It compares the Nigerian scenarios with some of the world's giant energy producers and economies, and defines measures aimed at achieving effectual management of her energy resources to improve Gross Domestic Product (GDP) and enlisting on the world's twenty (20) economies. The first part of this seminar series examines Nigeria's electricity generation/consumption strength and hence her present regional and global ranking with respect to world energy, and the probability of occupying a place in the ranking of the top twenty (20) economies of the world by 2020.

CONTENTS:

DEFINITION:

 # Energy Management means lowering cost by:

- . Eliminating unnecessary energy use
- . Improving the efficiency of necessary energy use
- . Buying energy at lower net prices
- . Adjusting operations to allow purchasing energy at lower prices.

 # Scenario is the outline of the plot of an action; postulated sequence of future events.

INTRODUCTION:

Energy use in developing countries has risen more than fourfold over the past four decades and is expected to continue increasing rapidly in the future. The increase in the services that energy provides is necessary and desirable, since energy services are essential for economic growth, improved living standards, and to provide for increased human populations. But finding the energy supplies to provide these services could cause major environmental, economic and social problems. Also, building dams or power plants to meet

higher demands for electricity could push these nations even deeper into debt. Energy development and use also contribute to local environmental damage in developing countries, including record levels of air pollution in some urban areas. The rapid growth of energy use in developing countries has wide impacts. Rapid increases in fossil fuel use in developing countries also represent a growing contribution to the increase in local and regional air pollution as well as atmospheric concentrations of greenhouse gases such as carbon dioxide (C02), International efforts to control greenhouse gas emissions require active participation by developing countries. Many developing countries could be adversely affected by climate change, some much more than most industrial nations. An economically and environmentally sound approach to energy development offers potentially large benefits both for the developing countries and for the rest of the world. It can contribute to economic growth in the developing countries, leading to higher living standards, reduction of hunger and poverty, and better environmental quality. This strategy also holds benefits for the richer countries. Improved energy technologies can slow the rate of increase in greenhouse gas emissions a global benefit[1].

Nigeria is Africa's energy giant. It is the continent's most prolific oil-producing country, which, together with Libya, accounts for two-thirds of Africa's crude oil reserves. It ranks second to Algeria in natural gas. Most of Africa's bitumen and lignite reserves are found in this country. In its mix of conventional energy reserves, Nigeria is simply unmatched by any other country on the African continent. It is not surprising, therefore, that energy export is the mainstay of the Nigerian economy. Also, primary energy resources dominate the nation's industrial raw materials endowment[2].

Nigeria's industrialisation depends largely on how its energy resources (oil, gas, bitumen, coal, lignite) are harnessed either as fuel or as industrial feedstock. Over-dependence on oil is evident from the fact that oil revenue, as a percentage of the nation's total export earnings, soared from 13.5 per cent in 1956 to 96.5 per cent in 1979. Since then, crude oil production has accounted for 30 per cent of GDP and about 80 per cent of total government revenue[2].

In keeping with its policy of regional cooperation with sister African nations, Nigeria recently entered into negotiations with five West African states (Republics of Ghana, Togo, Benin, Niger and Cote D'ivoire) under the West African Gas Reserves Project (WAGRP). The aim is to ensure that in the event of serious power interruption in those countries, Nigeria's National Electric Power Authority (NEPA, now PHCN) will switch them on. Nigeria already supplies electricity to Chad Republic. Also, under the West African Gas Pipeline Project, Nigeria is to supply gas regionally [3].

The government of Nigeria has embarked on a programme of reforming its electricity industry as a means of improving efficiency, productivity and ultimately low electricity prices to end-users.

The Executive Vice Chairman, National Government Strategies (NeGSt), Dr Olu Agunloye, said, "The Vision 2020 could be realised if electricity generation increased to 50,000 MW by 2015" [4].

THE NIGERIAN ENERGY OVERVIEW

In view of analysing and hence managing the Nigerian energy resources, four approaches are outlined:

- Identifying the Nigerian opportunities

- Prioritising Nigeria's actions rationally
- Accomplishing the activities successfully (**IPP, NIPP, JVC** etc)
- Maintaining the Energy management activities (**DSM, EE, RENEWABLE,** ETC)

1.0 Identifying The Nigerian Opportunities

Table 1: Nigeria's Energy Opportunities (Potentials) (ECN, 2008)[5].

ENERGY RESOURCES	RESERVE	UNIT
Crude oil	36.5	Billion barrels
Natural gas	187.44	Trillion scf
Tar sand	30	Billion barrels of oil equivalent
Coal and lignite	4	Billion tonnes
Large hydropower	11,250	MW
Small hydropower	3,500	MW
Fuel wood	13,071,464	Hectares
Animal waste	61	Million tonnes/yr
Crop residue	83	Million tonnes/yr
Solar radiation	3.5-7.0	Kwh/m^2 -day
Wind	2-4	m/s ~10m height

In summary, Table 1 identifies Nigeria's energy opportunities. The data in the table portray the nation's energy content, which when properly harnessed and rightly managed could give a face-lift to her energy production and consumption capabilities.

However, Table 2 shows the energy profile, which the nation recorded in recent years. This trend is most likely influenced by the energy management policies, technology, demands etc.

Table 2: Nigeria Energy Profile
(See chart attached)

As mentioned earlier, the first part of this seminar focuses on Nigeria's electricity potentials, including generation, demand, consumption per capita and power management scenarios.

THE NIGERIAN ELECTRICITY CAPACITY OVERVIEW

The Nigerian power sector operates well below its estimated capacity, with power outages being a frequent occurrence. To compensate for the power outages, the commercial and industrial sectors are increasingly using privately operated diesel generators to supply electricity. In 2004, the total installed electricity capacity was 5.9 gigawatts (GW) (Table 2), total electricity generation was 19 billion kilowatthours (Bkwh), whilst the total consumption was 18 Bkwh. Only 40 percent of Nigerians have access to electricity, the majority of whom are concentrated in urban areas.

Despite endemic blackouts, customers are billed for services rendered, partially explaining Nigeria's widespread vandalism, power theft and Power Holding Company of Nigeria's (PHCN's) problems with payment collection.

In spite of these abnormalities, the nation has an electricity projection feature as shown in Table 3. On the optimistic scenario, Nigeria will improve in ranking, as compared to the African high rated countries with respect to power, such as South Africa.

Table 2: Nigeria Energy Profile

Energy Data	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Petroleum ('000 Barrels/Day)											
Total Oil Prod'n	2139.79	2160.04	2136.31	2169.14	2261.42	2123.32	2278.59	2331.70	2630.17	2442.60	2352.38
Consumption	277.25	260.10	251.97	245.57	305.69	303.95	288.47	277.07	300.00	312.06	F 312
Net Exp/impts(-)	1862.54	1899.94	1884.34	1923.57	1955.73	1819.38		1990.12	2054.62	2330.17	2130.54 F2040
Total Oil	**Exports to**										
U.S.	698	696	657	896	885	621	867	1140	1166	1114	1132
Refinery Capacity		433	439	439	439	439	439	439	439	439	439
Proved Reserves		15.521	16.786	22.500	22.500	22.500	24.000	24.000	25.000	35.255	35.876 36.22
(Billion Barrels)											
Natural Gas (Billion Cubic Feet)											
Production	206.6	208.4	245.4	440.0	526.2	501 5	716.9	769.9	791.1	995.9	
Consumption	206.6	208.4	219.3	237.7	219.3	224.6	300.5	329.1	365.9	375.0	
Net Exp/impts(-)	0.0	0.0	26.1	202.4	306.9	276.9	416.4	440.7	425.2		
Proved Reserves	104,717	114,852	124,000	124,000	124,000	124,000	124,000	159,000	176,000	184,660	181,900
	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0	.0
	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Coal (Million Short Tons)											
Production	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Consumption	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Net Exp/impts(-)		-0.2	-0.2	-0.1	-0.1	0	0	0	0	0	0
(Trillion Btu)											
Electricity (Billion Kilowatt-hours)											
Net Generation	14.7	14.7	15.4	14.1	14.8	19.0	19.4	20.7	22.5		
Net Consumption		7.9	8.6	8.4	8.5	8.8	12.6	12.5	13.1	16.9	
Installed Capacity											
(GWe)	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9	5.9		
Total Primary Energy (Quadrillion Btu)											
Production		4.8	4.9	4.9	5.2	5.5	5.2	5.7	5.9	6.5	
Consumption		0.9	0.8	0.8	0.8	0.9	0.9	1 0	1.0	1.1	
Energy Intensity (Btuper		7135.4	6685.7	6828.9	6488.6	7093.3	7170.1	6779.6	6428.8	6563.3	
2000) U.S. Dollars)											
Carbon Dioxide Emissions (Million Metric Tons of CO_2)											
Total											
from Consumption of		91.8	88.6	84.6	80.4	91.2	92.2	91.8	105.2		
Fossil Fuels											

F=Forecast

Source: 6,7,12,13,14

The government proposes to generate certain minimum power requirement before 2020. She proposed to generate 15,000MW of electricity by 2008, 20,000MW by 2010 and 200,000MW by 2020. Transmission and distribution lines projects were to be embarked upon to cover the entire country. Recognising the primary role of gas, to the generation capacity, government also factored pipeline construction into the programme, working harmoniously with the generation. Fifteen (15) gas lines were awarded[8 9].

Table 3: Electricity Demand and Supply Projection (by energy source)[5]

SCENARIO	HYDRO	COAL	GAS	NUCLEAR	RENEWABLE
Reference	10	6	72	2	10
High Growth	7	11	70	2	10
Optimistic	7	11	70	4	8

Table 4: Electricity Demand and Supply Projection, cont'd (by date)[5]

Scenario	2005	2010	2015	2020	2025	2030	Reference	
							Algeria	South Africa
Reference	394	548	782	1153	1751	2734	800	4500
High Growth	394	556	842	1367	2362	4372		
Optimistic	394	558	875	1514	2845	5826		

On a world note, electricity generation capabilities of some countries are shown in Table 5.

TABLE 5: WORLD ELECTRICITY GENERATION ABILITY (RECENT) BY SOME COUNTRIES[10]

Rank	Countries	Amount (top to bottom)
#1	Japan:	226,000,000 killowatts
#2	Germany:	114,000,000 killowatts
#3	Canada:	111,000,000 killowatts
#4	Italy:	69,000,000 killowatts
#5	Korea, Sout	50,000,000 killowatts
#7	Norway:	27,200,000 killowatts
#8	Argentina:	24,000,000 killowatts
#9	Indonesia:	21,400,000 killowatts
#10	Venezuela:	21,000,000 killowatts
#14	Portugal:	11,000,000 killowatts
#15	Kuwait:	8,500,000 killowatts
#16	Singapore:	6,700,000 killowatts
#17	Nigeria:	5,900,000 killowatts
#18	United Arab Emirates:	5,600,000 killowatts
#20	Ecuador:	3,500,000 killowatts
#22	Qatar	1,500,000 killowatts
#23	Ghana:	1,200,000 killowatts
#24	Guatemala:	1,150,000 killowatts
#26	Cote d'Ivoire	890,000 killowatts
#27	Angola:	586,000 killowatts
#28	Brunei:	410,000 killowatts
#29	Gabon:	300,000 killowatts
#30	Senegal:	235,000 killowatts
#31	Congo, Democratic Republic of the:	118,000 killowatts
#32	Libya:	0 killowatts

Source: Energy Information Administration, US Department of Energy

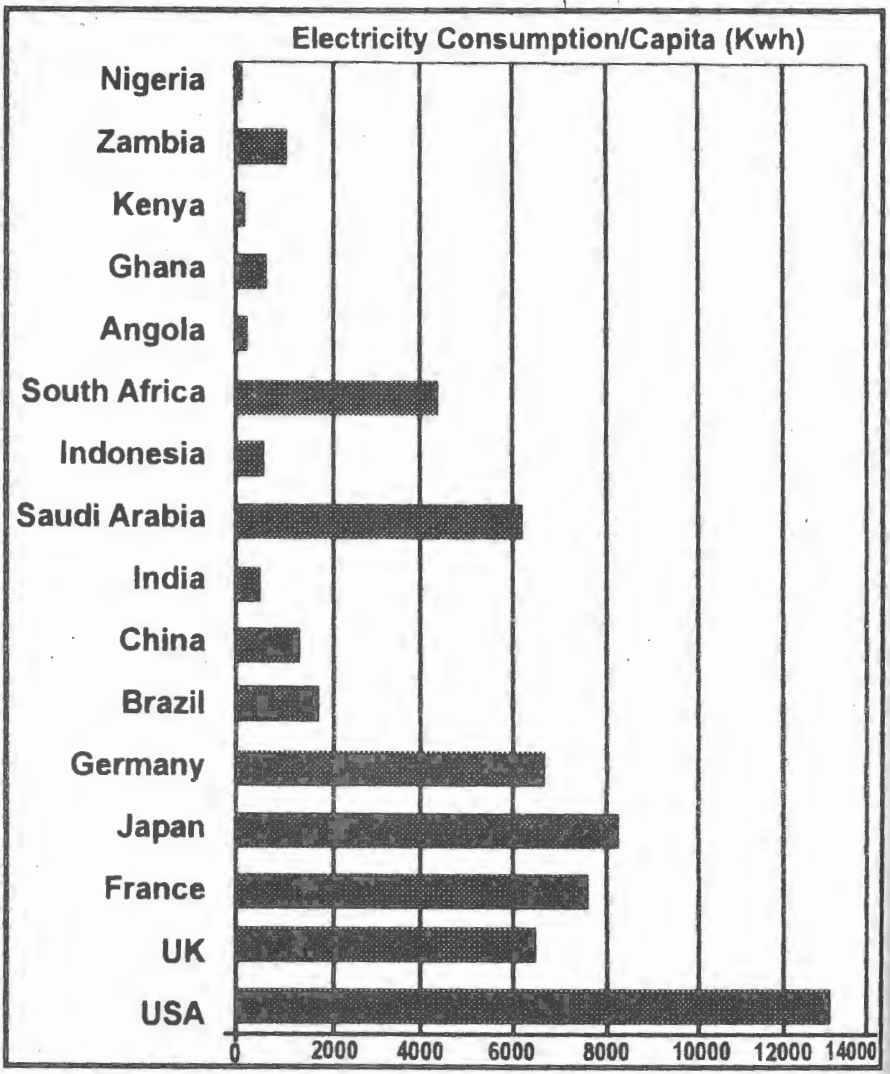
TABLE 6 : ELECTRIC GENERATION ABILITY (PER CAPITA) BY COUNTRY[11]

RANK	COUNTRIES	AMOUNT (TOP TO BOTTOM)
#1	Norway:	5.92206 kilowatts per person
#2	Kuwait:	3.6387 kilowatts per person
#3	Canada:	3.38363 kilowatts per person
#4	United Arab Emirates:	2.18494 kilowatts per person
#5	Japan:	1.7737 kilowatts per person
#6	Qatar:	1.73802 kilowatts per person
#7	Singapore:	1.51378 kilowatts per person
#8	Bahrain:	1.45276 kilowatts per person
#9	Germany:	1.38297 kilowatts per person
#10	Italy:	1.18755 kilowatts per person
#11	Kazakhstan:	1.13921 kilowatts per person
#12	Brunei:	1.10108 kilowatts per person
#13	Portugal:	1.04108 kilowatts per person
#14	Korea, South:	1.02794 kilowatts per person
#15	Venezuela:	0.827586 kilowatts per person
#16	Oman:	0.699534 kilowatts per person
#17	Argentina:	0.607011 kilowatts per person
#18	Mexico:	0.36628 kilowatts per person
#19	Thailand:	0.296015 kilowatts per person
#20	Ecuador:	0.261898 kilowatts per person
#21	Gabon:	0.215208 kilowatts per person
#22	Philippines:	0.136586 kilowatts per person
#23	Guatemala:	0.0957217 kilowatts per person
#24	Indonesia:	0.0884393 kilowatts per person
#25	Vietnam:	0.0598544 kilowatts per person
#26	Ghana:	0.0546797 kilowatts per person
#27	Cote d'Ivoire:	0.051451 kilowatts per person
#28	Angola:	0.0495476 kilowatts per person
#29	Nigeria:	0.0458195 kilowatts per person
#30	Senegal:	0.0200752 kilowatts per person
#31	Congo, Democratic	0.00194194 kilowatts per person
#32	Libya	0 kilowatts per person
	Weighted average:	1.0 kilowatts per person

SOURCE: Energy Information Administration, US Department of Energy

**Note: Nigeria is far lower than world weighted average.

Fig. 1. COMPARISON OF ELECTRICITY CONSUMPTION/CAPITA



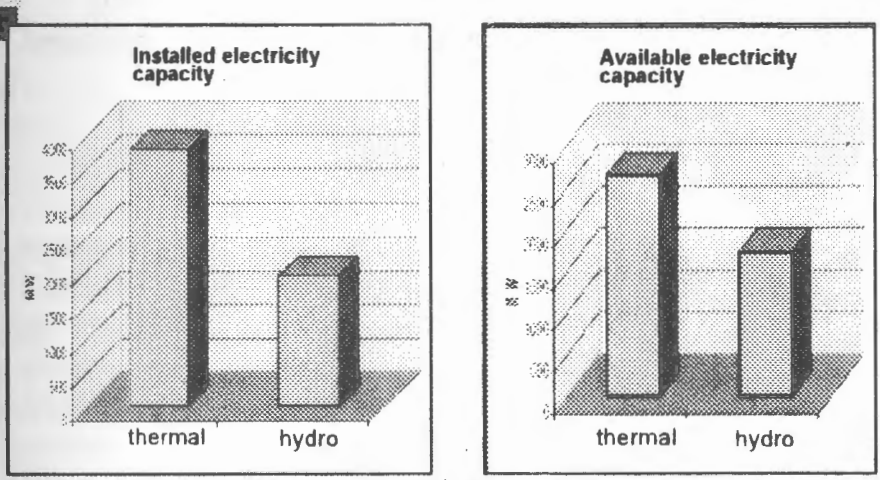


Fig. 2: Nigerian Electricity Sector (2007)

THE SCENARIO OF THE NIGERIAN POWER CHALLENGE

The limitation in the Nigerian power infrastructure may be poor planning or visualisation of where the country should be, poor implementation of the few good plans, limited or no funding, poor management system, security anxieties and environmental considerations [8]

The Nigerian power challenge can be tied to some of the following points as summarised below:

- Achieving socio-economic development is a function of adequate and reliable power availability
- Inadequate supply restricts socio-economic activities to basic human needs, limits economic growth and adversely affects quality of life
- Grossly inadequate Electricity supply in Nigeria: Total installed capacity is far less than demand

- Installed capacity is much greater than available capacity
- Meaningful Economic and Social Development is hampered by very low per capita electricity consumption

THE NIGERIAN ELECTRICITY CHALLENGE

Nigeria is a member of the proposed West African Power Pool (W APP). The transmission inter-connection between Nigeria and Niger Republic is expected to be upgraded to 142MW capacity by 2020 under the West African Power Pool Project. It is also expected that the transmission inter-connection between Nigeria and Benin Republic will be upgraded from 560MW capacity at the commencement of the WAPP project and gradually built up to 2767MW capacity by 2020. In accordance with National Energy Policy, there is strong need to expand the energy mix for national generation, to enhance energy security[5].

Despite not being able to meet the current demand, the nation's electricity demand continues to grow in response to:

-ever increasing population
-urbanisation,
- improved living standard,
- economic development.

Addressing all the challenges is critical to meeting the needs of a growing population, expanding our economy, and raising the standard of living of the people.

ENERGY CHALLENGE AND ECONOMIC DEVELOPMENT

Securing higher living standards for the increasing population of the developing world implies high rates of economic growth. The process of economic development that underlies improving living standards in

developing countries involves a number of changes, including higher agricultural productivity, growth of manufacturing, construction of a modern public works infrastructure, urbanisation, and increased transportation. Higher standards of living also lead to expansion in the ownership of consumer appliances. All of these changes have profound impacts on the amounts and types of energy used. Commercial energy consumption typically rises faster than economic growth as the development process gets underway, and the share of commercial energy in total energy consumption grows as it takes the place of traditional biomass fuels. Even though the relative share of traditional fuels has declined, the absolute amounts consumed have continued to rise, by an estimated 2.5 percent per year [12]

CONCLUSION

Nigeria should champion an integrated pool of African nations and international funding agencies to finance a continental power project so that the projected electricity demand for Africa could be met. This will enhance the chances of meeting the MDGs surpassing them and even enhancing the possibility of being amongst the top twenty economies by 2020[12].

African countries including Nigeria should put in place the appropriate facilities, regulatory policies and legal frameworks that will facilitate the importation of electricity from the integrated network. The establishment of the integrated power project and subsequent importation of electricity by Nigeria will go a long way in helping to meet the projected electricity demand in Nigeria and the realisation of her dreams to be part of the top twenty economies which for now is very oblique. There is a very close relationship between energy, environment and socio-economic development[7].

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