Efficiency of the Energy Sector and its Impact on the Competitiveness of the Nigerian Economy

By Adeola Adenikinju*

Introduction

The oil sector has dictated the pace and structure of growth of the Nigerian economy since 1970. Oil contributed over US$391.6 billion to government revenue between 1970 and 2005. This accounted for 77.1 per cent of total government revenue over the period. Out of this amount, US$118.4 billion or 30.2 per cent was earned between 1999 and 2005. Similarly, the Nigerian economy has earned over US$593.6 billion from oil exports, representing 96.3 per cent of total foreign exchange earned between 1970 and 2005. Out of this amount, US$153.1 billion or 25.8 per cent was earned between 1999 and 2005.

The country is currently experiencing its longest boom ever. Oil booms have increased the consumption levels of both the government and the ordinary citizens, albeit, these levels have not been sustained nor translated into a permanent increase in the standard of living of Nigerians. The history of oil in Nigeria has been characterized by almost an equal measure of progress and retardation, blessings and curse, hope and hopelessness, wealth and poverty and inability to translate the good luck of oil to build an efficient modern society. Nigeria has experienced all the phases of oil – the good, the bad and the ugly.

Apart from its direct fiscal effects, the energy sector is strategic for increasing the competitiveness of the Nigerian economy, be it as a way of reducing overall energy costs or as a way to further modernize the technology used by economic agents and businesses. Countries have, therefore, taken significant efforts to ensure the efficiency of their energy sector. The focus of this presentation is on the efficiency of the energy sector, in particular, the power sub-sector and the extent to which this has impacted on the competitiveness of the Nigerian economy.

The Nigerian Energy Sector

Nigeria is fortunate to have huge energy resources, which potentially give the country ample opportunity to transform her economy and the lives of her citizens. Nigeria sits astride of over 35 billion barrels of oil, 187 trillion cubic feet of gas, 4 billion metric tones of coal and lignite, as well as huge reserves of tar sands, hydropower and solar radiation, among others.

For understandable reasons, Nigeria has not devoted equal attention to her abundant energy resources. Her efforts have been concentrated on the development, exploitation and utilization of crude oil and gas for fiscal objectives and the electric power to generate electricity to power the economy. Table 1 shows the profile of the Nigerian electricity industry infrastructure.

Generation	Pre-1999	Post-1999
- Thermal	4,058 MW	5,010 MW
- Hydro	1,900 MW	1,900 MW
Installed capacity	5,996 MW	6,910 MW
Available Capacity	1,500 MW	4,451 MW
Transmission.		
- 330kv line	4,800 km	4,889.2 km
- 132kv lines	6,100 km	6,284.06 km
Transformer capacity		
330/132KV	5,618 MVA	6,098 MVA
132/33KV	6,230 MVA	7,805 MVA
Distribution.		
- 33kv lines	37,173 km	48,409.62 km
- 11kv lines	29,055 km	32,581.49 km
- 415v lines	70,799 km	126,032.79 km
Transformer capacity	8,342.56 MVA	12,219 MVA

Source: Maigida (2008)

Table 1: Profile of the Electricity Industry Infrastructure

A key point that emerges from the table is that there has been very marginal improvement in electricity infrastructure over the years. Between 1985 and 2000, electricity generation capacity grew by a mere 10 per cent in Nigeria compared to 332 per cent in Vietnam, 142 per cent in Iran, 237 per cent in Indonesia, 243 per cent in Malaysia and 205 per cent in South Korea (Maigida, 2008). Electricity generation capacity is also far below comparator countries. Nigeria, with a population of over 150 million people, has an installed generation capacity of 6000MW compared to UAE 4740MW to a population of 4 million or South Africa that has 46000MW to 44million people.

Efficiency of the Nigerian Energy Sector

Energy efficiency is a concept expressed by a set of measures or the effects of those measures whose objective is a reduction of energy consumption such that consumer satisfaction is maintained. Energy efficiency is not simply confined to the manage-

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ment of demand, but can also be applied to production, transport and distribution of energy.

A common indicator of energy efficiency is the index of energy intensity which measures the quantity of energy required to generate one dollar unit of aggregate output. The lower the value of energy intensity, the more efficient an economy. Figure 1 shows the trend in energy intensities for selected countries – Nigeria, South Africa, Algeria, Brazil and China. Brazil has the most efficient energy sector, follow by Algeria and Nigeria, while South Africa and China have the least energy efficiencies. However, beyond this aggregate picture, is a more relevant picture of the trend in efficiency over time in each of the countries. From the trend in the graph, China recorded the highest improvement in energy efficiency over time. Algeria also recorded some improvements. Energy efficiency, however, remained fairly stable in South Africa, and Nigeria, while efficiency declined in Brazil.

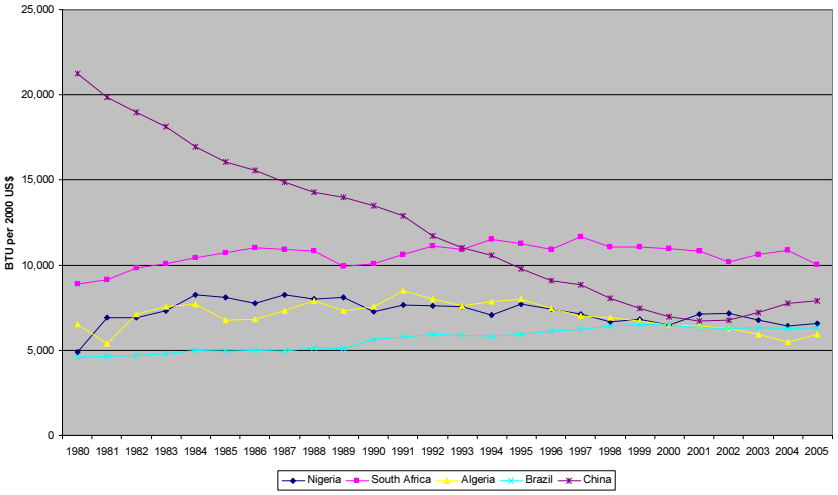


Figure 1: Trend in Aaggregate Energy Intensities for Selected Countries

Efficiency of the Power Subsector

The statistics on the power sector have been appalling. Only about 40 per cent of Nigerians have access to electricity. In terms of efficiency and performance, the Nigerian electric power sector has been rated by the UNDP/World Bank Report 1993 as having one of the highest rate of losses (33%), the lowest generating capacity factor (20%), the lowest revenue at 1.56c/kWh, the lowest rate of return (-8%) and the longest average account receivable period (15 months), among a group of 20 low income and upper income countries.

However, over a decade after the conclusion of the UNDP/World Bank Report, the story has not radically changed. Electricity tariffs are below the cost of service and there is poor revenue collection. According to Tallapragada and Adebusuyi, (2008), about 30-40 per cent of power supplied is never billed. The power sector incurs a cash loss of around US$2billion per month. Over US$400 million annually is spent by the Federal Government of Nigeria as an annual subsidy to cover losses and investment, an amount that is higher than the Federal budget for health.

Indicators	**Nigeria**	**Average Africa**	
		Low income Countries	**Middle Income Countries**
1.Technical efficiency:			
(i) Ingeneration capacity (MW)	598	918	13651
(ii) MW per million pop.	42	32	404
(iii) MW in operation condition as % of installed capacity	61	84	97
(iv) Per capita (kWh/cap)	173	141	1912
(v) Self-generated as % of electricity generated	42	10	0.7
2. Effective residential tariff (cents/kWh)	4.1	12	32
3.Quality			
Number of unplanned outages per year	1059	3082	39
4.Efficiency			
(i) Labour efficiency (ann. labour costs as % of operational expenses)	48	29	11
(ii) Average revenue (cents/kWh)			
5. Efficiency ratios (%)			
(i) T & D losses)	30	25	13
(ii) Cost recovery (based on effective tariff)	36	64	56
(iii) Implicit collection (based on effective tariff)	52	83	95
6. Total hidden costs of inefficiencies			
(i) as % of GDP	1.4	2.0	0.6
(ii) as % of utility revenue	229	125	13

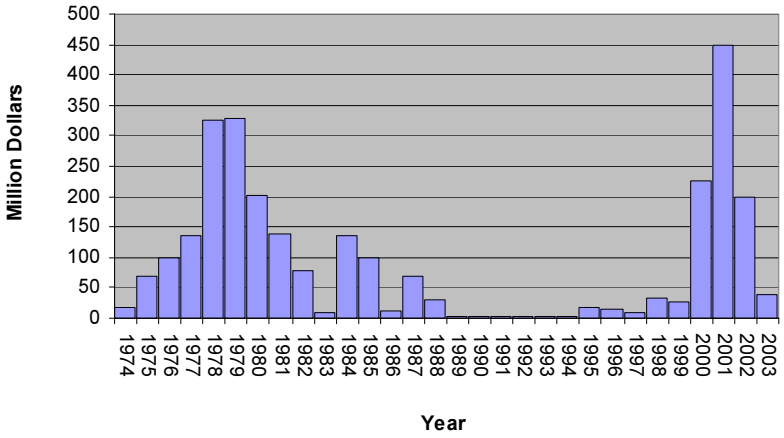
Source: Derived from Eberhard, A., V. Foster, C. Briceno-Garmendia, F. Ouedraogo, D. Camos and M. Scharatan (2008)

Table 2: Selected Power Sector Indicators of Performance for Nigeria and Africa, (2004-05)

Table 2 provides an interesting comparison of selected power sector indicators of technical and financial efficiencies between Nigerian and the average for a group of African countries. Nigeria efficiency performance on all counts is much worse than for a set of middle income African countries. In 2004/05, installed generation capacity in Nigeria was a mere 42MW per million people compared to 404MW for middle income African countries. The share of self electricity generated in total electricity generated in Nigeria was 52 per cent compared to less than 1 per cent for Middle income African countries. The number of unplanned outages in Nigeria was also 30 times more than what obtained in the former group of countries. Labor efficiency is also poorer in Nigeria. Labor costs account for 48 per cent of operational costs compared to 29 and 11 per cent for low middle and middle income African countries respectively.

A bane of the power sector remains the low funding of the sector as well as the inability of revenue to cover costs. Cost as a percentage of tariff declined from 83.3 per cent in 2001 to 42.6 per cent in 2003 before rising to 66.5 per cent in 2004. In view of other demands on its revenues, the government has shown itself unable to continue to shoulder past energy financing responsibilities. Figure 2 shows the historical funding levels by government for PHCN operations since 1974.

The problem of inadequate gas supply has also been an important challenge faced by the power sector. Gas currently accounts for 75 per cent and 67 per cent of installed and available electricity capacities in the country respectively. However, as the current experiences with the new power plants built by the government have shown, gas security will continue to pose a major challenge for the power plants now and in the near future.



Source: Makoju (2007) cited in Adegbulugbe and Adenikinju (2008)

Figure 2: The Low Growth Rate in the 80s and 90s was Due to Poor Funding & Neglect of the Nigerian Power Sector

Impact of Energy Sector Efficiency on the Competitiveness of the Economy

An evidence of the impact of the poor quality, unreliability and limited availability of power supply on Nigeria's economic development is its debilitating effects on the industrialization process. Nigerian manufacturers have consistently identified poor power supply as the most important constraint to their businesses. The majority of them have to supplement publicly supplied electricity with very expensive auto-generation. Removing the constraint of unreliable power generation will ,therefore, enhance the microeconomic response of the real sector to the various government incentives. Table 4 shows that respondents rank the two energy input electricity supply (93.2 per cent) and petroleum shortages (50.6 per cent) as either moderate or major obstacles to their businesses in Nigeria. Table 5 further shows the share of total investment devoted by firms to their own provision of electricity facilities. This costs as expecteds varies inversely with the scale of operations of the firms. Small scale firms spend on the average between 10 to 20 percent of initial investment on self generation compared to large scale firms that spend less than 10 percent. However, across all the firms, the additional investment costs borne by these firms to mitigate the unreliability of NEPA is an avoidable cost that simply increases the costs of business operations in Nigeria.

Station	Initial Capacity (MW)	Capacity Available (MW)	Capacity Operational (MW)	Comments
1. Gereku	414	414	140	Insufficient gas supply. Additional 434MW planned
2. Omotosho	335	300	75	Insufficient gas supply. Additional 700MW planned
3. Olorunsogo formerly Papanlato	335	300	75	Insufficient gas supply. Additional 700MW planned
4. Alaoji	515	0	0	Under construction. Additional 1000MW planned
Total	1599	1014	290	

Source: Oke (2008)

Table 3: Status of Government Owned Power Plants and Availability

Way Forward: Lessons for the Future

In spite of recent reforms, the challenges ahead are tremendous. A growing economy requires massive energy to power it. Recent estimates have shown that to achieve the Vision 2020 goal of making Nigeria one of the twenty largest economies in the world, electricity generation will have to increase from the present level of 3650MW to about 45000MW. The achievement of this projected generation capacity in the country will ensure that by 2020, per capita electricity consumption in Nigeria exceeds the critical minimum prescribed by the

Infrastructure	No	Moderate	Major
	-------Obstacle-------		
Land	8.1	4.9	4.3
Electricity	1.9	10.5	82.7
Water	19.8	13.6	4.3
Telecommunication	1.2	14.8	34.0
Road	13.6	6.8	1.2
Petroleum shortages	22.2	48.1	2.5

Source: Adenikinju (2003)

Table 4: Ranking of severity of Infrastructure Problem in Nigeria

United Nations but will still be below the 2003 figure for South Africa.

However, the current efforts to delivering the massive investment required to meet the national aspirations with respect to the energy sector have not been encouraging. Past reforms, because of the way they have been managed have not delivered on their promises. Actual electricity expansion continues to fall short of government projections. For instance, while government planned to deliver over 7000MW of electricity by 2007, actual delivery was under 3000MW.

However, there are several ongoing efforts to boost power supply in the future. These efforts involve both the government and private sector initiatives. The successful completion of these projects will no doubt contribute to enhancing the competitiveness of the economy.

Proportion	Small	Medium	Large
	-------Scale-------		
0 to 10 percent	28.8	35.5	56.0
10 to 20 percent	35.6	29.0	20.0
20 to 30 percent	10.2	25.8	14.0
More than 30 percent	25.4	9.7	10.0

Source: Adenikinju (2003)

Table 5: Proportion of Total Investment at Start Up Devoted to Provision of Own Electricity Facilities by Firm Size

Name	1st Phase Capacity (MW)	2nd Phase Capacity (MW)	Total (MW)
1. Installed hydro	1,900	0	1,900
2. Future Hydro	2,639	3,610	6,249
3. Installed thermal	5,976	1,922	7,898
4. Ongoing Thermal	4,793	2,400	7,193
5. Private IPPs	6,591	8,174	14,765
Total	21,899	16,106	38,005

Source: Oke (2008)

Table 6: Summary of Total Proposed Installed and Future Potential Capacities

What Do We Need To Do?

(1) Develop competitive energy markets: Competitive energy markets will play a major role in developing and deploying new technologies. Strong competition in the electricity markets has a positive effect on the efficiency of power generation, because market players want to minimize their costs and invest in efficient technologies. We need to enhance the efficiencies of end-use technology.

(2) Provide the environment conducive for private sector investments in the energy sector. Energy sector investments, whether for exploration and exploitation of energy minerals or for the establishment of downstream energy infrastructure such as power plants, transmission and distribution networks, are characterized by huge capital demands, a long term investment horizon and advanced technology. In addition, due to the low level of development of the domestic technological and industrial base, the demands for investment funds in foreign currency far outweigh that for local currency.

First is the issue of an appropriate electricity pricing framework that will enable investors not only recoup their investment but also allow the sector to generate funds for new investments for expansion as presently obtains in the telecommunication sector. Second, there is a need for an established policy related to the liquidity support that government is willing to provide to developers of gas to power infrastructure. Presently, each investor that arrives in Nigeria with a project concept negotiates its own support package, which is an undesirable outcome from at least two perspectives: (a) it constitutes an opaque, non-transparent process and takes up a great deal of time; and (b) it becomes difficult for government to periodically monitor, evaluate and manage its exposure to the various non-uniform support packages that are approved.

Third, development of alternative energy sources are important both to diversify our supply mix, and to provide access to Nigerians living in rural areas. Current statistics show that over 65 per cent of Nigerians live in the rural areas. These Nigerians, if deliberate efforts are not made, may be neglected by the current reforms as grid expansion may take a long time to get to them. Hence, there is an urgent need to consider non-grid supply options. Recent surveys by UNIDO and other agencies in Nigeria have shown huge potentials for small hydro plants, wind, solar, cogenerations and within the gate power supply options.

Fourth, urgently address the issue of gas supply security. Gas fired power plants currently dominate the power generation mix. The dominance of gas over other types of fuels for power generation is due to its relative abundance and the lower cost of gas fired power plants. However, in recent times the weakness of the structure of the power generation mix has become very glaring. First, gas supply is geographically localized in the Niger Delta region; and second, the incidence of disruption of gas supply pipelines, has increased, reducing power supply and causing significant social and economic losses. The unreliability of gas supply has rendered the power supply system unstable and unpredictable.

Conclusion

The energy sector has played a significant role in the economic development process, in particular through the provision of revenue to finance socio-development projects of all the tiers of government.

However, while the sector has largely fulfilled its fiscal objective, the inefficiency of the power subsector has constrained the competitiveness of the productive sectors of the economy and has imposed significant costs and distortions on the economy.

While the challenges of reforming the energy sector to make it deliver reliable and affordable energy inputs to the economy are huge, there are reasons to be hopeful. The Multi Year Tariff Order (MYTO) has been approved by the government, some institutional structure to ensure the competitiveness of the sector like the Nigerian Electricity Regulatory Commission (NERC) is in place. The government has approved the Gas Master Plan as well as New Gas Pricing and Allocation Policy. Nigeria now also has a National Electricity Master Plan, and the Electricity Reform Act has been enacted.

However, there is a need to address other issues that we have raised in this paper: appropriate funding, gas supply security, small power producers, maintenance of existing energy supply infrastructure, adequate coordination of activities among various stakeholders in the energy sector, expansion of transmission and distribution networks, and enlightenment of the public on issues of energy use efficiency. The government should also faithfully implement the recommendations of the Power Sector Reform Committee as well as the Oil and Gas Reform Committee.

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