Nigeria's Dual Energy Problems: Policy Issues and Challenges

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The Nigerian energy industry is probably one of the most inefficient in meeting the needs of its customers globally. This is most evident in the persistent disequilibrium in the markets for electricity and petroleum products, especially kerosene and diesel. The dismal energy service provision has adversely affected living standards of the population and exacerbated income and energy poverty in an economy where the majority of the people live on less than $2 a day. Yet, energy and income poor Nigeria is energy resource rich and the sixth largest exporter of crude oil in the world. Nigeria's persistent energy crisis has weakened the industrialization process, and significantly undermined the effort to achieve sustained economic growth, increased competitiveness of domestic industries in domestic, regional and global markets and employment generation. Against this background three key issues are discussed in this paper: namely; the nature of the crises, the causal factors in the crises; and how to eliminate the crises and establish a sustainable domestic energy future in the context sub-regional energy sustainable development.

Nature and Causal Factors in Nigeria's Energy Crises

Our starting point of analysis is some facts about Nigeria's energy crises. First, is the persistent inadequate quantity, poor quality and low access to energy despite the enormous domestic endowments of non-renewable and renewable primary energy resources. For example, crude oil and natural gas reserves are currently estimated at 35 billion barrels and 185 trillion cubic feet, respectively. These fossil fuel reserves are more than adequate to fuel much of Sub-Saharan Africa energy demand for several decades.[1] Coal reserves are also substantial at 2.75 billion metric tons. Also, a large amount of renewable energy resources including hydro electricity, solar, wind and biomass energy are present. Hydro resources are estimated at 14,750 Megawatts. Solar radiation is estimated at 3.5-7.0 Kilowatthour/m2 per day, wind energy 2.0-4.0 m/s, wind energy at 150,000 Terra Joule per year and biomass at 144 million tons per year.[2] Second, despite being a world ranking exporter of liquefied natural gas (LNG), Nigeria's gas-dominated electric grid experiences frequent system collapse linked often to inadequate gas supply. The oil-linked militancy which has resulted in gas and oil pipeline vandalisation in the oil and gas producing Niger Delta region has exacerbated the petroleum products and electricity supply problems. Largely unrestrained gas flaring has consistently put Nigeria among the world's largest source of carbon emission, a major factor in global warming.[3] Third is the extensive substitution of poor public electricity supply with highly polluting self-generated power. Also the scarcity of kerosene combined with shortage-induced high kerosene prices has induced greater use of fuelwood for the low and middle income classes with adverse environmental consequences. Diesel shortages have crippled industrial production dependent on diesel-generated private electricity supply. Finally, there is the protracted nature of the energy crises. Nigeria's chronic energy infrastructural gaps which have existed since the large scale inflow of oil income in the mid 1970s has worsened in recent times despite huge amounts of public expenditure in this government dominated and controlled industry. The billion dollars of pubic investment into capacity expansion in the energy industry contrast sharply with the extremely poor supply outcomes measured by refinery output, rise in imported fuels and frequent power outages and voltage variation.[4]

The nature of Nigeria's dual energy crises is highlighted by two key developments. The first concerns the recurrent severe petroleum products market shortages of which kerosene and diesel are the most prominent. Nigeria has five domestic refineries owned by the government with capacity to process 450,000 barrels of oil per day, yet imports constitute more than 75% of petroleum products requirements. The state owned refineries have hardly operated above 40% capacity utilization rate for any extended period of time in the past two decades. The gasoline market is much better supplied than kerosene and diesel because of its higher political profile. This factor explains why the government has embarked on large import volumes to remedy domestic shortages of the product. According to the Minister for Energy the subsidy to support the imports of gasoline alone will be in the range of N700 to N800 billion in 2008. The weaker political pressures exerted by consumers of kerosene (the poor and low middle class) and diesel (industrial sector) on the government and the constraints on public financing of large scale imports of these products, as in the case of gasoline, largely explains their more severe and persistent market shortages.

The second dimension of Nigeria's energy crises is exemplified by such indica-

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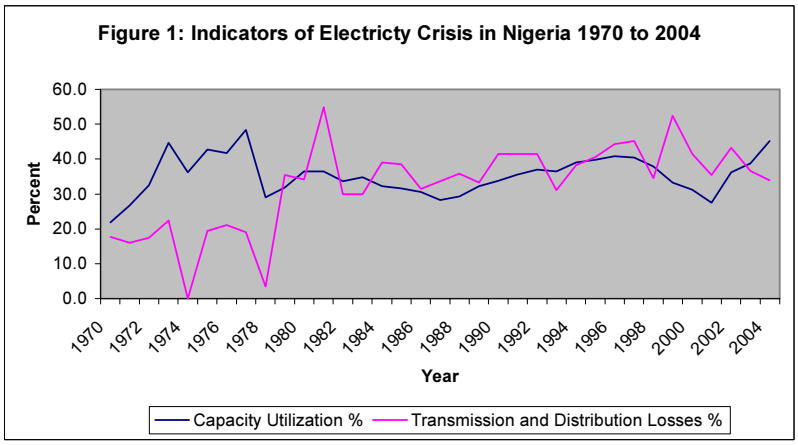
tors as electricity black-outs and brown-outs and pervasive reliance on self-generated electricity. This development has occurred despite Nigeria being energy-resource abundant. Nigeria's electricity market, dominated on the supply side by the state-owned Power Holding Company of Nigeria (PHCN) formerly called the National Electric Power Authority (NEPA) has been incapable of providing minimum acceptable international standards of electricity service reliability, accessibility and availability for the past three decades. The nature of the poor record in electricity supply is apparent in the trend in transmission and distribution losses shown in Figure 1. The double digit transmission and distribution losses are extremely large by international standards are among the highest in the world. The system losses are five to six times what obtain in well-run power systems. The high level of power losses and the significant illegal access to public power supply are indicative of the crisis in the industry.



Source: Data from PHCN and NEPA

The trend in capacity utilization provides another perspective on the electricity crisis (Figure 1). The low and unstable capacity utilization, evident in an average capacity utilization of less that 40% for most of the period, shows the large gap between installed and actual operational capacity. It is a reflection of the gross technical inefficiency in the power system. The role of insufficient operational capacity due to ageing facilities that are poorly maintained on poor service provision is indisputable. Remarkably, despite the size of inoperable capacity, no new plant has been added to the grid since 1990. The installed power generating capacity is about 6,000 MW. The operable capacity is less than 3,000 MW. This is made up of hydroelectric and gas-fired power generating plants. The plant mix is dominated by gas-fired plants. The infrastructure facilities are not only old, they are also beset by water flow and gas supply problems. The water flow problems which have seriously undermined the performance of the three hydro stations (Kainji, Jebba and Shiroro) in recent years are linked to reduced water volumes in the River Niger and its tributaries due to climate change. Increased frequency of gas supply disruptions to gas-fuelled generating plants have also reduced electricity generation. Gas pipeline attacks have exacerbated the power supply problem through disruption in gas supplies to the power stations.

Though peak electricity demand has been less than half of installed capacity in the past decade, load shedding occurs regularly. Power outages in the manufacturing sector provide another dimension of the crisis. In 2004, major manufacturing firms experienced 316 outages. This increased by 26% in 2005 followed by an explosive 43% increase between 2006 and 2007. Though no published data exist, near collapse of the generating system to far below 2000 MW for prolonged periods of time suggest that the number of outages in 2008 will also be very high. This poor service delivery has rendered public supply a standby source as many consumers who cannot afford irregular and poor quality service substitute more expensive captive supply alternatives to minimize the negative consequences of power supply interruptions on their production activities and profitability. An estimated 20 percent of the investment in industrial projects is allocated to alternative source of electricity supply.

In concluding the discussion in this section, the causal factors in Nigeria's energy crisis include:

- prevalence of a regime of price control;
- weak concern for cost recovery and lack of adequate economic incentives to induce the state-owned companies (NNPC and PHCN) to engage in efficient production and investment behaviour. This seems apparent in the existence of large input and output subsidies;
- multiplicity of economic and non-economic objectives without proper identification of the trade-offs among these different objectives. This is implicit in its pricing policies in both electricity and petroleum products markets.
- institutional and governance failures which induced gross distortions and inefficiency in production, investment choices and high costs of operation, low return on investment and expensive delays and cost overruns in the state energy enterprises.

The recent reversal of the privatization process evident in government plans to strengthen the two public companies in the energy industry raises some concerns about government intentions in the two

industries. The government is planning to strengthen PHCH and empower it to build more power plants and NNPC to build more refineries notwithstanding the history of poor investment and production outcomes from public energy enterprises.

Transition to Competitive Energy Markets: Policy Issues and Imperatives

It is widely recognized that substantial expansion in quantity, quality and access to energy infrastructure services, are essential to rapid and sustained economic growth, employment generation, poverty reduction and overall well-being of the population in a country where most of the 140 million people are poor. Thus, the persistent suboptimal levels of energy infrastructure capacity and service provision from both growth and welfare maximization perspectives raises the fundamental question: What ought to be done to establish and sustain a robust energy industry characterized by acceptable international standards of service reliability, accessibility and availability and that will support sustainable human development in Nigeria and the West African region. Overcoming the energy crises and ensuring international standards in quantity, access, quality and reliability of energy services in Nigeria is a prerequisite for achieving the desire of the government that Nigeria be one of the top 20 economies in the world by 2020. This defines the scale of policy challenges for energy infrastructure investment and operations. Also, additional factors include three important initial conditions associated with electricity and petroleum products crises. These are the current low level of electricity and energy consumption per capita by global development standards; the depressing state of socio-economic conditions in an economy just recovering from almost two decades of poor performance and deepening poverty; and the low human development indicators. The wide energy gap and poverty in comparative regional terms is apparent in per capita electricity consumption in Nigeria being 140 Kwh in 2004 compared to 1337 Kwh in Egypt and 4560 Kwh in South Africa.[5] The government projects that generating capacity should increase to eliminate current electricity poverty and raise electricity per capita to 1,110kwh in 2015 and 5,000Kwh in 2030. Even then, Nigeria's per capita consumption in 2030 will be about 20% above the level that obtained in South Africa in 2003!

Meeting the challenges of providing adequate, reliable and widely accessible electricity service involves more than summing up numbers (the mega-watts, cubic metres of gas delivery or barrels of domestically refined and distributed oil) and getting other technical things right from the domestic perspective. The domestic solutions to investment, production and delivery problems should be enlarged to factor in the West African region given the two ECOWAS energy initiatives, the West African Power Pool (WAPP) and West African Gas Pipeline (WAGP). Domestic energy supply expansion must be examined in the context and integrated into ECOWAS energy given the current regional WAGP and WAPP as forerunners of the proposed integrated West African energy market. It is obvious that regional energy infrastructure investment and supply policies must be mutually consistent and properly coordinated.

The peculiar nature and initial conditions in the industry may suggest some roles for the government in the production and delivery of electricity. This is particularly so if only one of the 23 Independent Power Producers (IPP) given licences by NERC to add 8237 MW to existing capacity has done anything tangible. There is some reluctance among the licensees to begin observable construction activities. Part of the problem is the attempt by IPP to lock in high tariff into their power purchase agreement (PPA) and its take-or-pay clause for unnecessarily long periods though production could come from more efficient plants in the future. It was partly to prevent the foreign private IPP's from holding the country to ransom because of the power crisis that the Obasanjo Administration as an interim measure close to the end of its tenure decided to embark on a rapid expansion of generating plant capacity with assistance from the Chinese. In all, seven power stations were planned to be constructed in the Niger Delta region to utilize flared gas under the suspended but controversial National Integrated Power Project (NIPP). In addition, a new large 2,600MW hydro project costing US$3.46 billion with assistance from the Chinese government is also underway. Though the NIPP has been suspended, the decision should be revisited given the reluctance of the private sector to set up power plants. After construction, these plants should be privatized or concessioned to guarantee efficient service delivery.

Government intervention through NIPP will moderate the scaling up in the tariff that the sector requires to provide affordable and adequate electricity. Power pricing that guarantees an attractive rate of return to investors adjusted for industry risk and security of investment and input are two important considerations in private sector investment in the industry. The new multi-year tariff scheme which is yet to be fully operational is an important step in bringing new capital to the electricity industry. Effective implementation of the core reforms in the Electricity Power Sector Reform Act would ensure industry operation based on global best practices. From the petroleum products perspective, the plan of the gov-

ernment to phase out the subsidy for gasoline and truly free the products market in 2009 following recent shortages in kerosene and diesel is highly desirable.

While both renewable and non-renewable energy resources will be utilized in meeting future energy demand, the continued dominance of fossil fuels supplemented by hydroelectricity is envisaged in the medium term. Coal, hydro, solar, biomass, wind and nuclear energy technologies are alternative electricity generation options under consideration. Developing and deploying cleaner energy should be part of the investment strategy with the focus however on progressively adopting cleaner fossil fuels based on renewable energy sources to meet rural electricity demand. Notably, the government plans to achieve 10% of electricity supply to be derived from renewable resources by 2025.[6] Coal and nuclear energy also feature on the investment option list. 5000 MWe of nuclear generating capacity is expected by 2026.

The projected amount of investment to meet domestic power system expansion in 2030 is estimated at about $262 billion. This amount is enormous given the antecedent of the industry. Though the financial requirement is daunting, it is achievable. However, success is contingent on the right institutional framework, policy consistency, appropriate incentive structure and security of investment to guarantee the flow of required investment. The successful privatization of the telecommunication industry which brought in more than $12 billion of new investment in the last four years provides support for this position. The dramatic turn around of a moribund public telecommunication utility to a vibrant private sector-led industry with one of the fastest system growth rates in the world has been due to the combination of right institutional framework, policy consistency and appropriate incentive structure.

The mobilization of the financial resources to support a dramatic scaling up of energy infrastructure capacity must factor in the risks associated with investment to strengthen the refining and pipeline and distribution network and power supply system. These risks are in four dimensions: economic, sociopolitical, technological and environmental (methane leaks, climate change compatibility, nuclear accidents spills). Optimal sharing of these risks among the three principal market actors, namely, consumers, investor/producers and the government is essential to efficient resource allocation in the industry for a sustainable energy future in Nigeria and the West African sub-region. Having the appropriate incentive structure anchored on industry restructuring, privatization and sound regulatory framework, and financial support for renewable energy will improve the likelihood of success in achieving a vibrant Nigerian energy industry as the hub of West African energy.

Finally, there is the issue of security of supply of oil and gas pipelines associated with resource control agitation in the Niger Delta. Effort to eliminate tension in the region is more urgent than ever before. Developing and procuring and applying best practices in the industry will impact the volume and quality of investment.

Conclusions

The main conclusions of this paper are that the elimination of the electricity curse and emergence of the required strong investment response are contingent on:

- Radical reform in the sector emboding changes to improve and strengthen the industry governance structure to enhance accountability and minimize corruption;
- Strengthening current reform anchored on restructuring of both the petroleum and power industries to create a more competitive energy market anchored on market-responsive energy pricing.
- Elimination or minimization of concerns about security of supply of gas associated with resource control agitation in the Niger Delta region. Credible and decisive effort to eliminate tension at the core is more urgent than ever before.

However, the current government attempt to slow down and reverse the reform plans embodied in the Electricity Power Sector Reform Act will impede the faster actualization of equilibrium in the energy markets. A new partnership between the public and private sectors would have to be forged to meet these challenges. The scale of disequilibrium in the energy markets and poor quality of supply coupled with the social, economic and environmental costs of large scale substitution of inefficient fuel alternatives, strongly suggest the immense need of new investment and more efficient operation of its energy infrastructure. Ultimately what is important to the consumers and producers in Nigeria and the ECOWAS region is elimination of the disequilibria in the energy markets in Nigeria and more importantly, giving them wide accessibility to affordable and environmentally friendly energy supply in the context of the Millennium Development Goals (MDG).

Footnotes

[1] The share of Nigeria in global reserves of oil and gas are respectively 3% (BP Statistical Review of World

Energy).

[2] See Ibitoye and Adenikinju (2007).

[3] The persistent flaring of oil-associated gas is partly due to the reluctance of multinational oil companies to invest in the gas gathering facilities for domestic use. Another factor has been their willingness to pay the low penalties for flaring gas.

[4] The amount of public spending on electricity infrastructure between 1999 and 2004 far exceeded what was spent between 1981 and 1998 yet the crisis persisted.

[5] This is derived from Energy Information Administration, International Energy Annual 2004. DOE, Washington DC.

[6] See Energy Commission of Nigeria (2005)

References

Adenikinju, A (2005) Analysis of the cost of infrastructure failures in a developing economy the case of electricity sector in Nigeria. African Economic Research Consortium AERC Research Paper 148, February 2005 Nairobi.

Energy Commission of Nigeria (2002) National Energy Policy. Abuja. August.

Energy Commission of Nigeria (2005) Renewable Energy Master Plan. Abuja. November.

Ibitoye, F and A. Adenikinju (2007) Future Demand for Electricity in Nigeria. Applied Energy 84, (2007), 492-504.

Energy Information Administration, International Energy Annual 2004. DOE, Washington DC.