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A TECHNICAL AND ECONOMIC EVALUATION OF THE ELECTRICITY GENERATION AND DISTRIBUTION SYSTEM IN NIGERIA

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ABSTRACT

Electricity is one form of energy. It occupies a special place in our civilization, because it is easier to use than many other types. It is clean, versatile and can be transported over long distances almost instantly. These factors account for why electricity has grown faster than other forms of energy and why this growth is expected to continue. Electricity generation and distribution in Nigeria is a business of government, and government vested that sole responsibility to the National Electric Power Authority (NEPA). Almost 30yrs of its existence, NEPA has not been able to meet the electricity needs for residential, commercial and industrial use. This paper is an exploratory appraisal of the economic and technical factors that has been responsible for the inability of NEPA to fulfil its statutory responsibility. The paper asserts that if the issues of electricity demand and supply, electricity tariffs, choice of technology for power generation and the efficiency of the electricity distribution networks are not addressed, the adequate supply of electricity in Nigeria will continue to be a mirage.

1.0 INTRODUCTION

Electricity is unique among forms. It is a derived product and not itself a fuel. It is a veritable form of energy which can be precisely controlled in its application, can be generated from a variety of fuels and is clean at the point of use. Without electricity many of the developments which have revolutionized life and industry in modern society would not have been possible. Computerization and other high technology developments depend on adequate and reliable electric power.

Electric power generation in Nigeria dated back to 1950 when the Federal government passed the Electricity Corporation of Nigeria (ECN) ordinance of number 15 of 1950, with the good intention of integrating power development in the country. In 1962, the Niger Dam Authority (NDA) was established for the purpose of construction and maintenance of dams and other works on the river Niger and elsewhere. However, the rate of electricity outages prevalent then indicated that there was a need for a thorough overhauling of the edicts, consequently the ECN and NDA were merged to become National Electric Power Authority (NEPA) by decree number 24 of 27th June 1972 (effective 1st April, 1972). Thus NEPA became the sole organization responsible for the generation, transmission, distribution and sale of electricity at economic rate.

The monopoly of NEPA has since been broken, in principle by an amendment in 1998, to the decree establishing it, thereby opening up the industry to private participation. However, in practical terms the monopoly still exists since none is yet to invest in the venture. The amendment provides for all intending investors to apply for approval through the ministry of mines and power. Interestingly the approval given to the Lagos State Government in conjunction with the ERON of America to generate electricity in Lagos by December 7th, 1999, has met with a lot of frustration both from NEPA and the Federal Government (FG).

However, 30yrs after the setting up of NEPA, it has not been able to meet the electricity requirements of the nation both in the residential, industrial and commercial sector and in recent times there has been calls for the privatization of the organization, the setting up of individual power stations by states and manufacturing organizations and even the breaking-down of the organization into smaller units to enhance its operational performance. At the present moment the corporation has a mandate from government to generate uninterrupted and adequate electricity 24hrs of the day by the 31st of December, 2001.

Thus this paper is an exploratory study into the economic and technical factors responsible for the dismal performance record of NEPA; from its inception to date.

2.0 ELECTRICITY POWER GENERATION IN NIGERIA

In the beginning, development of electricity was based on isolated power stations meant to meet specific needs of various communities. These were diesel generating sets, except for the hydro-electric power stations commissioned by NESCO in the 1920's and early 1930's to meet the requirement of mining operations in Jos, Plateau State.

By the middle of the 1950's the load growth in communities like Lagos, Ibadan, Enugu and Port-harcourt had grown to a level that needed steam turbines. Consequently in 1958, the former ECN commissioned Balfour Betty and Co. to investigate the hydroelectric potential of Nigeria around the Kanji, this study led to the establishment of the first hydro-power station for electricity generation in Nigeria; the Kanji Dam. In less than a decade of its existence, Kainji dam became a key factor in the development plans of the country, delivery more than the combined output of the thermal power stations at Afam, Delta, Ijora and other isolated power stations.

However, by the 1970's following the growth in electricity demand and realization that electricity was a major infrastructure that would be required if any meaningful progress must be 'made towards the industrialization of the nation, a consulting firm, Motor Columbus was commissioned in 1974 to study the electrical power system development in the country to the end of the century. On the basis of the statistics from the consultant review of the power market, NEPA was able to establish a growth pattern in demand and consumption. The consultants had also adjusted existing supply facilities and potential power market and from this point, developed a load forecast. Also based on certain criteria specified by NEPA, the consultants were able to identify 32 potential hydro-electric and 17 potential thermal generation sites in the country. The 1975 Motor Columbus plan for electric power system development, therefore became the basis for the power planning of the country from 1980 – 1995.

In line with this development plan, the Egbin thermal plant with a total generating power of 1320 MW of electricity was commissioned in 1986 and the Shiroro hydro-power station with a capacity of 600MW was commissioned in 1990. Today Nigeria has 8 power stations with an installed capacity which rose to 2,230.5; 4,548.0 and 4.548.6MW in 1980, 1990 and 1996.

However, in 1997 the nation was plunged into a nationwide power outage the first of its kind in the history of the nation. It was a national disgrace, of the 78 units of installed generating units nationwide only 40 units were available or 34% of the total grid installed capacity for power transmission. In the 1997 project monitoring report by the National Economic Advisory Council, the council observed that less than 50% of the existing power generating capacity in the country was available and asserted that the main operational constraints of NEPA were poor workshop and maintenance equipments and generally poor working environment in terms of remuneration and training of staff, and recommended the privatisation of the organisation. A similar recommendation was made by the vision 2010 committee set-up to look into the activities of the organization.

One of the motivating objectives of carrying out this exploratory study by the researcher stems from the fact that the researcher observed that most of those calling for privatization and restructuring of the organization have demonstrated a lot of naivety, for these people the problems of NEPA are simply the issue of ownership without realising the strategic importance of Electricity to the overall nation economy or the operational, economic and technical constraints the organization has to grapple with; it is therefore the objective of this study to objectively highlight the constraints of NEPA to guide in the various suggestions being made to bail the country out of its present electricity crisis.

3.0 RESEARCH METHODOLOGY

The efficiency of any electricity production system is a function of its ability to meet demand, and there are four basic factors that determine the demand of electricity overtime. These are changes in:

(1) the general level of economic activity, usually measured by GDP.
(2) the sectoral or product composition of an economy
(3) the technology of electricity generation
(4) the efficiency of electricity distribution.

These four factors were the fundamental issues considered in this economic and technical evaluation.

4.0 RESEARCH FINDINGS AND DISCUSSIONS

4.1 Economic Evaluation

(i) Electricity Demand

Table 1 shows the Electricity generation and consumption for the past 30 years. From the Table, it is clear that there has been an exponential demand for electricity in the last 30yrs and of the 3 sectors that consume electricity the household usage of electricity has grown very rapidly and stands at over 50% of total consumption, followed by the commercial sector and the industrial sector.

At the end of 1991 census, the country population stood at 88.5million with household size of 1 to 5.5 (FOS, 1995). As at 1994 survey 66% of the household has no electricity (FOS. 1995). From available date over 50% of the current electricity consumption is consumed by household which only satisfy about 34% of the household electricity demand. This implies that the household sector demands 300% of the

present consumption. In the industrial sector there has been a steady fall in capacity utilization which has suppressed demand for electricity in the sector. Capacity utilization has fallen from 41.6% in 1989 to 34.3% in 1998 and a modest increase to 36.1% by 2000. And also from available data electricity consumption in the sector has not increased beyond 22% in the last 5yrs; for capacity utilization of less than 35%. This also implies that at optimum operational level of the industrial sector, there would be requirement of an increase by the same margin of 300% to meet the needs of the industrial sector.

It can therefore be concluded that generating capacity of NEPA has been inadequate and there is a need to increase investment in the sector by either expanding the capacity of the present electricity generating plants or the establishment of new plants. Investments in the electricity sector of the country has run contrary to the universal norm, where the rate of new investment in energy projects must outstrip additional consumption by about 60%.

(ii) Electricity Tariffs

The decree setting up NEPA imposed economic efficiency and the element of viability on the corporation using tariffs which according to the decree must be sufficient to meet:

1. The salaries, working expenses and other out-going property charged to income in that year;
2. The payments of interest and repayment of the principal of any money borrowed by the enterprise
3. Any sums for the redemption of stock issued, and
4. Any sums decreed proper to be set-aside for reserve, extensions, renewals, depreciation etc.

Notwithstanding the requirements of the decree, NEPA has constantly charged electricity tariffs far below its Marginal Cost (MC) of producing one unit of electricity and presently NEPA charges the lowest electricity tariff per unit in Africa (Table 2). Even though the government approved increases in electricity tariffs in 1989, 1990, 1993, 1994, 1995 and 1996 from 7 kobo/kwh to 202.35 kobo/kwh is 1996 when converted there is in effect a decrease in tariff from 11 cents/kwh is 1980 to 2.47 cents/kwh in 1996. Apart from that, Nigerian electricity consumer are notorious for not paying up for services received and the total outstanding indebtedness to NEPA as at June 30th, 1996 stood at N12,477,442,811.00

4.2 Technical Evaluation

(i) Choice of Technology for Electric Power Generation

Electricity generation in Nigeria is by two processes hydropower and thermal plants; of the 8 power stations in the country only 3 of them are hydro-powered (Kanji, Jebba and Shiroro) while the other 5 are thermal plants. Thermal energy sources account for about 62.3% of total electricity generated while hydro-electricity sources supplied 37.7%. While the country has managed well with the hydro-powered plants, the electricity generation from the thermal plants have often been set-backs to the country. For example the latest thermal plant in the country, the Egbin power plant was commissioned in 1986 amidst pomp and peagantry, with a lot of expectation that electricity generation would improve substantial. The plant had six units, operating with a fuel/gas reheat steam electric system and is capable of generating a nominal rating of 220MW per unit (total 1320 MW). And was built by the Moncho of Canada and Mitsubishi of Japan. Two years after commissioning one unit broke down and 3yrs later another unit was shut down.

It is therefore recommended that in the future development of electricity generation units in the country, emphasis should be placed more in the development of hydro-power stations rather than thermal plants for the following reasons:

1. Hydro is a renewal source of energy and does not require the use of coal, oil or gas
2. Hydropower is essentially non-polluting
3. A multipurpose hydro plant with storage facilities can control floods and can substantially increase the amount of water available for agriculture
4. The energy reserve from a hydro plant is almost instantly available, which makes it ideally suited for reacting to changing load demands and for providing peak power.
5. Hydro power plants have a long life and will only require periodic refurbishing of its components
6. A significant advantage of a hydropower plant for a developing country like Nigeria is that a hydro plant requires fewer and less skilled operating personnel than does a thermal plant.
7. With its large civil components, hydro plants requires a smaller percentage of foreign exchange and a smaller percentage of imported skilled labour.

(ii) Efficiency of Electricity Distribution

The electricity generated at the hydropower and thermal plants are delivered to the end users by the use of transformers. The rating of these transformers are in KVA (Kilo Volts Ampere). In virtually all of the operation of NEPA in the distributive aspect, it is still carried out using 300KVA transformers, were due to the increase in household sizes there should have been installed transformers of 500KVA rating. This small size of transformers has often led to overloading and sometimes blow-up of transformers. Apart from that NEPA has been afflicted by the non-refurbishing of old, worn-out and out-dated parts, this has led to frequent breakdown of generating units, coupled with under funding by government which has seriously undermined the efficiency of the distributive aspect of electricity supply to consumers.

5.0 Summary and Conclusion

That Nigeria is presently going through an energy crisis in the electricity sector is not news, but to over-simply the solution to the problem by restricting it to the problem of the structure of ownership of NEPA is misleading. From the foregoing, even if the organization i.e. NEPA is privatised or broken-down into smaller units, if the issues of electricity demand and supply, electricity tariffs, choice of technology for power generation and the efficiency of electricity distribution are not adequately addressed, the December deadline to meet the supply of 24hrs of electricity will be a mirage.

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