ASSESSMENT OF ENERGY GENERATION / AVAILABILITY IN NIGERIA FROM 1996 TO 2004

By

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ABSTRACT

May 29, 1999 Nigeria government changed from military system of government to democratic system. The paper assessed the energy generation/availability from 1996 to 2004 from all power stations and compared the performance of generation under the two systems of government. Discussions were on generation availability, constraints, and system disturbances. New policies introduced were also highlighted and problems faced in energy generation discussed. Recommendations were made on the way forward.

1.0 INTRODUCTION

Nigeria, in Western Africa, has a total area of 923 800 km2. The country's population as announced by Federal Government based on National Population Census carried out in 2006 is over 130 million. Nigeria's power demand is high but the actual generation is well below the demand. As a result, the country experiences an energy supply crisis.

In terms of energy resources, Nigeria is currently the world's eight largest oil producer with daily production of nearly 3 million barrels per day and a reserve of about 30 billion barrels. Coal and lignite reserves are estimated at 2.7 billion tonnes, large-scale hydropower at 10,000MW and Biomass potential at 187 million tonnes per year. Solar radiation intensity of up to 1.0KW/m2 peak is attainable in some parts of Nigeria and Wind energy is available at annual average speeds of between 2.0m/s to 4m/s.

Electricity is treated as an essential social service, the present supply is characterised by erratic power supply to industries, inadequate coverage in terms of geographic spread, leaving out large number of villages and covering less than 40% of the population, with a record low per capita consumption. Petroleum and gas, coal and lignite, hydro, biomass and solar power account for the remaining energy sources.

The country has proven gas reserves and around 8,000 MW of hydro development is planned. Nigeria has plans to increase access to electricity throughout the country to 85% by 2010 (Esan, 2003). Electricity supply in the

country has been through centralized generating station (hydro and thermal) with high capacities (above 100MW). The major operator in the Nigerian electric power station is presently the Power Holdings Company of Nigeria (PHCN). The supply was about 80% of the total electricity consumption in the country with about 6000MW installed capacity. This is from three (3) large hydro power stations, Shiroro, Jebba and Kainji with other six (6) thermal power stations with a total installed generating capacity of 5906 MW, its maximum suppressed demand is about 4,500MW. The demand for electricity is shared between residential, industrial, commercial/street lighting in the proportions: 50:30:20(Akanmu, 2006), while 2 to 5% of the capacity of the national grid is contributed by independent power producers (IPP) such as NESCO, Shell, AES-Lagos, Bayelsa state gas turbine and Ajaokuta Steel company. These private producers sell power to PHCN for transmission and distribution to consumers, while the other balance of power demand in the country is being supplied by private generating sets. The estimated demand for power in 2005 is about 9780MW (Akanmu, 2006). This will require a generating capacity of about 12700MW.

2.0 Annual Energy Generation

In Nigeria there are three (3) large hydro power stations, in operation, Shiroro, Jebba and Kainji and five (5) thermal power stations such as Sapele, Afam, Egbin, Delta, Ijora presently operated by PHCN. Independent power stations include AES, Calabar, Aggreco, geometric and others. The thermal and hydropower plants energy generations for 1996 to 2004 are contained in and Fig.1. Annual Average energy was computed from monthly average MW which was computed by averaging the daily generation in the month.

It is quite clear from the Fig.1 that there is marginal decrease of about 0.5% continuously from 1996 to 1998. The drop in energy generated in 1997 from 1996 was attributed to the decline in the flood yields into Kainji lake during the flood seasons and low gas constraints in thermal plants. In 1998 there is about 5.5% increase in energy production, however, in 1999 there is about 2% decrease from 1998 value, this decrease continue to about 6.3% in year 2000. If year 2000 is used as base year for the present democratic system, then there has been continuous increase in energy production and as at year 2004 the percentage increase has risen to 158.5%, hence the dividend of democracy can be said to be gained in energy production, though demand also increased. Fig 2 to Fig 5 shows monthly energy generated by all power stations in 1996, 1999, 2000 and 2004 respectively.

3.0 Annual Energy Generation Availability/ Constraints

The annual average energy generation availability from 1996 to 2004 are as follows: 3031.16, 2546.00, 2515.17, 2379.11, 1957.58, 2366.99, 2975.17, 3431.39, 3409.97

respectively. Fig 6 and 7 gives details of power stations average Megawatt availability for January – December 2004 and summary of generation availability of power stations (1996-2004).

Fig.8 shows Year 2004 power stations installed capacities with megawatt availability. In 1997 Hydro and Thermal plant availability average was 2,546.45MW. This was just only 8.13% lower than 1996 figure of 2771.66MW while hydro plants availability for 1999 was lower than 1998 the drop was due to plants that were down requiring rehabilitation. During the year 2000, Hydro/Thermal plant availability average was 1953.78MW. This was (17.85%) lower than 1999 value of 2378.41MW. In the year 2001 the total hydro/thermal plant average availability was 2366.99MW, this value was 21.155% higher than year 2000, this was due to the addition of more units rehabilitated and new unit installed in Afam power station. In 2002 the total plants availability was 50.69% higher than 2001. The 2004 annual thermal availability was 2.5% lower than 2003 while the hydro plants availability was 2.4% higher than 2003 values, this was due to optimal operation of the hydro plants.

4.0 CONCLUSIONS AND RECOMMENDATIONS

Electricity supply in the country has been through centralized generating station (hydro and thermal) with high capacities (above 100MW). The major operator of the Nigerian electric power station is the Power Holdings Company of Nigeria (PHCN). The supply was about 80% of the total electricity consumption in the country with about 6000MW installed capacity from three (3) large hydro power stations, Shiroro, Jebba and Kainji with other six (6) thermal power stations with a total installed generating capacity of 5906 MW, its maximum suppressed demand is about 4,500MW. The demand for electricity is shared between residential, industrial, commercial/street lighting in the proportions: 50:30:20, with 2 to 5% of the capacity of the national grid contributed by independent power producers (IPP). The IPP are NESCO, Shell, AES-Lagos, Bayelsa state gas turbine and Ajaokuta Steel Company. These private producers sells power to PHCN for transmission and distribution to consumers, while the other balance of power demand in the country is being supplied by private generating sets. The estimated demand for power in 2005 is about 9780MW. This will require a generating capacity of about 12,700MW.

The following recommendation should be critically examined and follow: Future Hydro Development should emphasis on variable blades (Kaplan) units which are more flexible in operation i.e. enhances optimal water management, broaden grid system spinning reserve base and aid system frequency control. There are already too many base load units in the system hence these posed great difficult in

frequency control. To black start the system after a major system shutdown these units were not helpful for they cannot be part loaded during restoration. Development of Horizontal Hydro Turbine Generators of lower rating should be considered by management hydropower stations.

Efforts by IPP should be encouraged; the political leaders should allow the energy/power policy work. Renewable energy (RE) should be harnessed to boost the generation; the available renewable energy master plan in place should be implemented, public information on RE should be enhanced for public acceptability. Regular staff training in every field of operations should be intensified. In addition to training, the right working tools should also be provided for the staff.

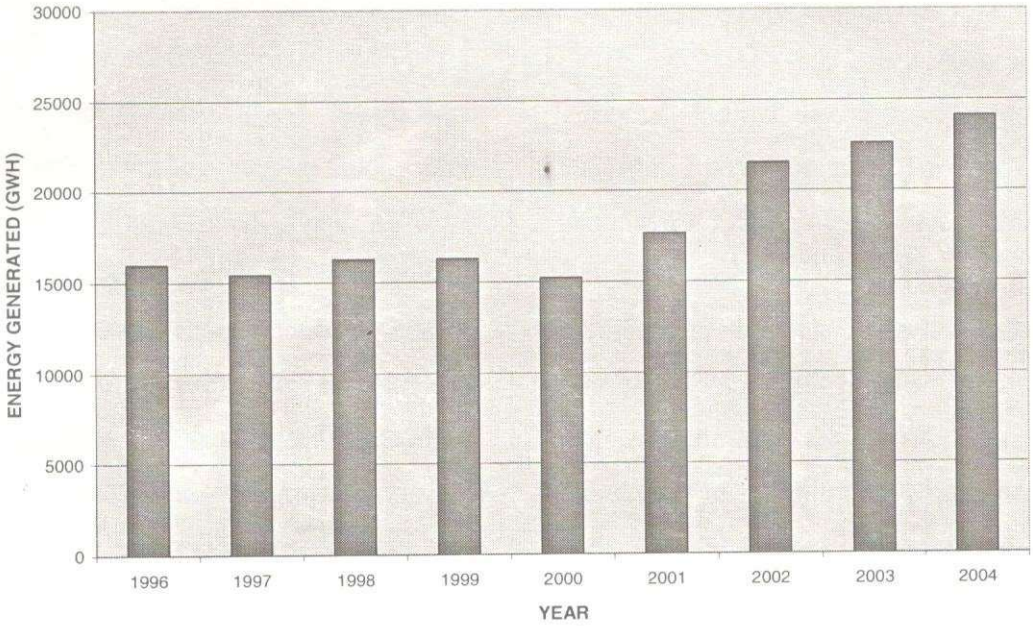

Figure 1: ANNUAL ENERGY GENERATED (GWH)

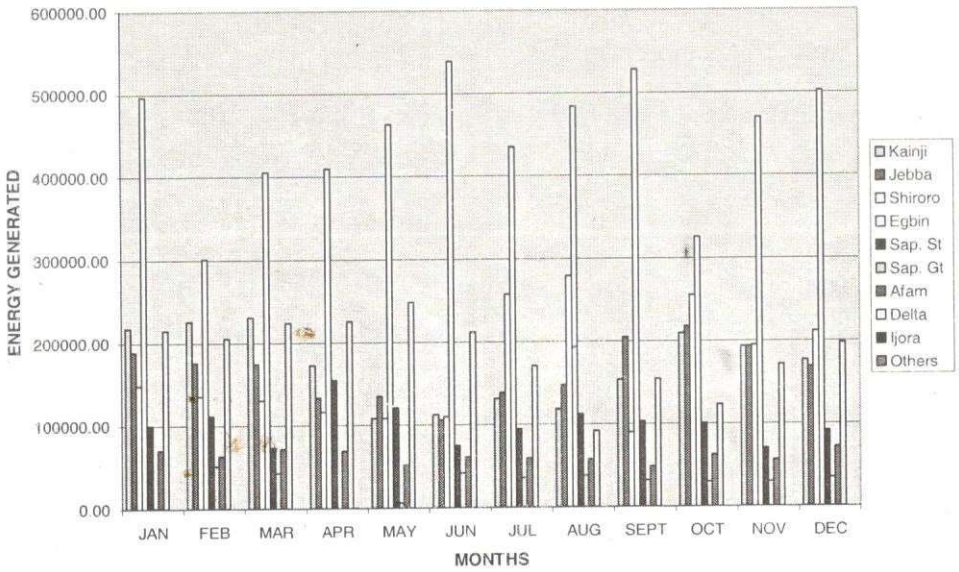

Figure 2: MONTHLY ENERGY GENERATED (MWH) BY POWER STATION 1996

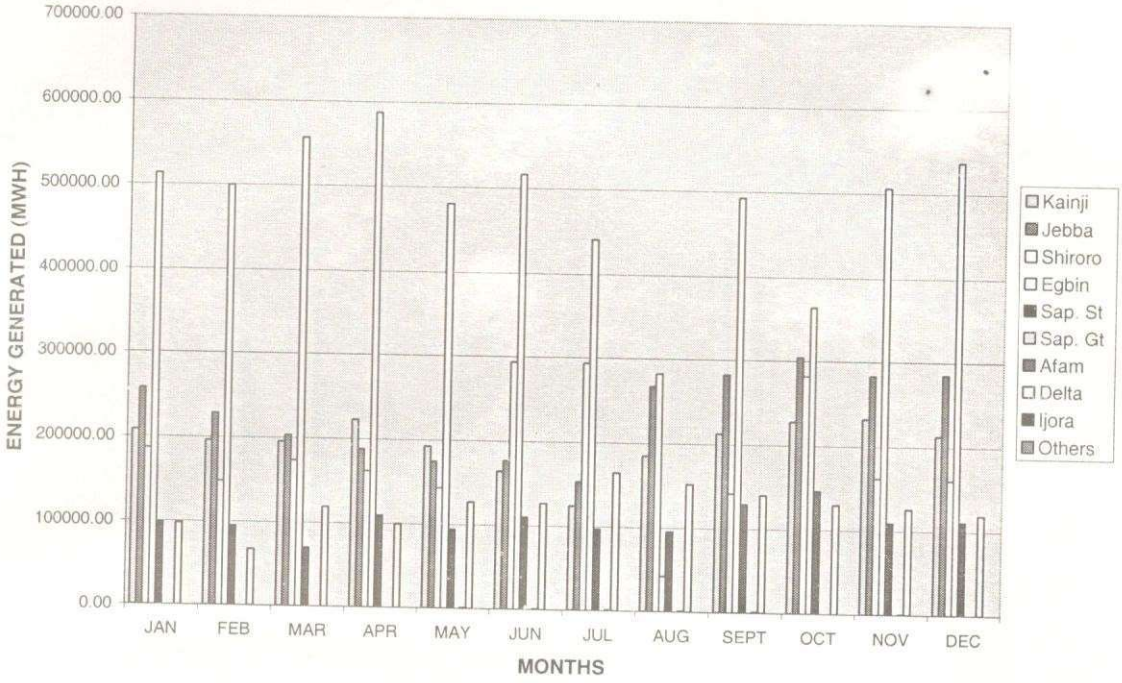

Figure 3: MONTHLY ENERGY GENERATED (MWH) BY POWER STATIONS 1999

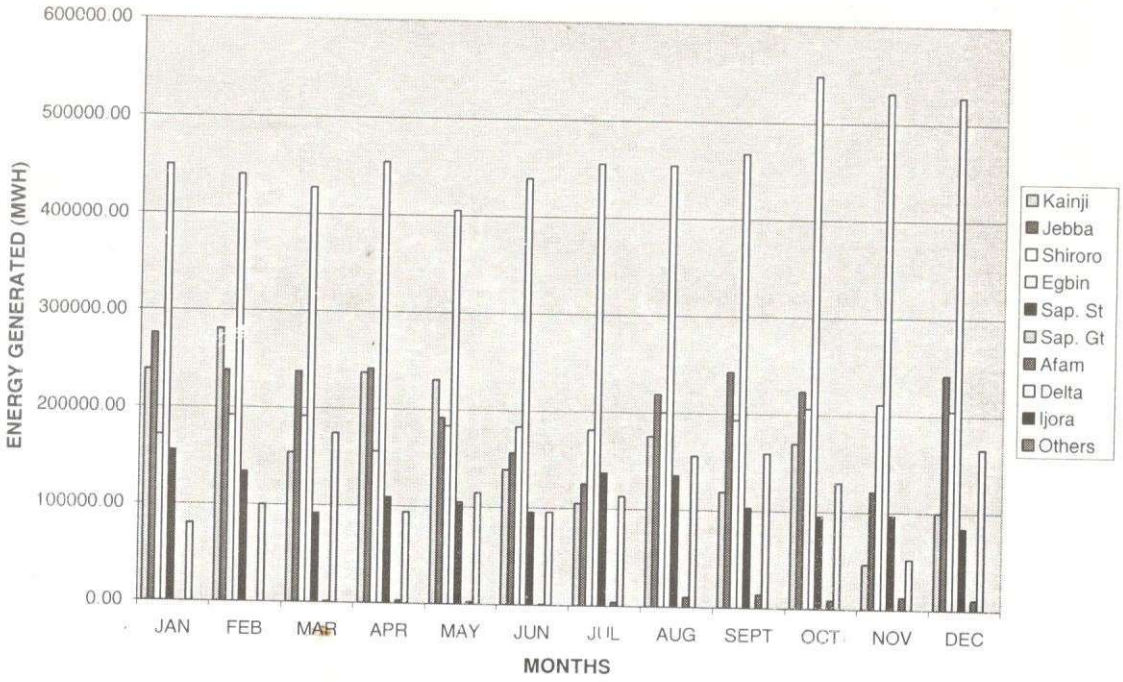

Figure 4: MONTHLY ENERGY GENERATED (MWH) BY POWER STATION 2000

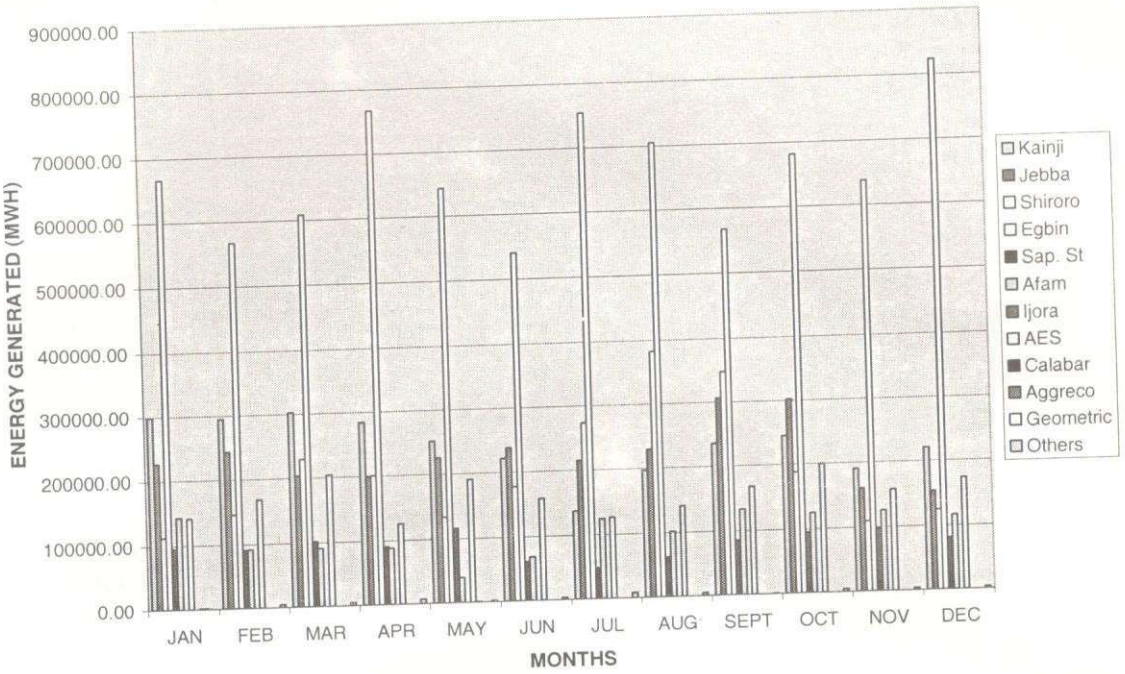

Figure 5: MONTHLY ENERGY GENERATED (MWH) BY POWER STATION 2004

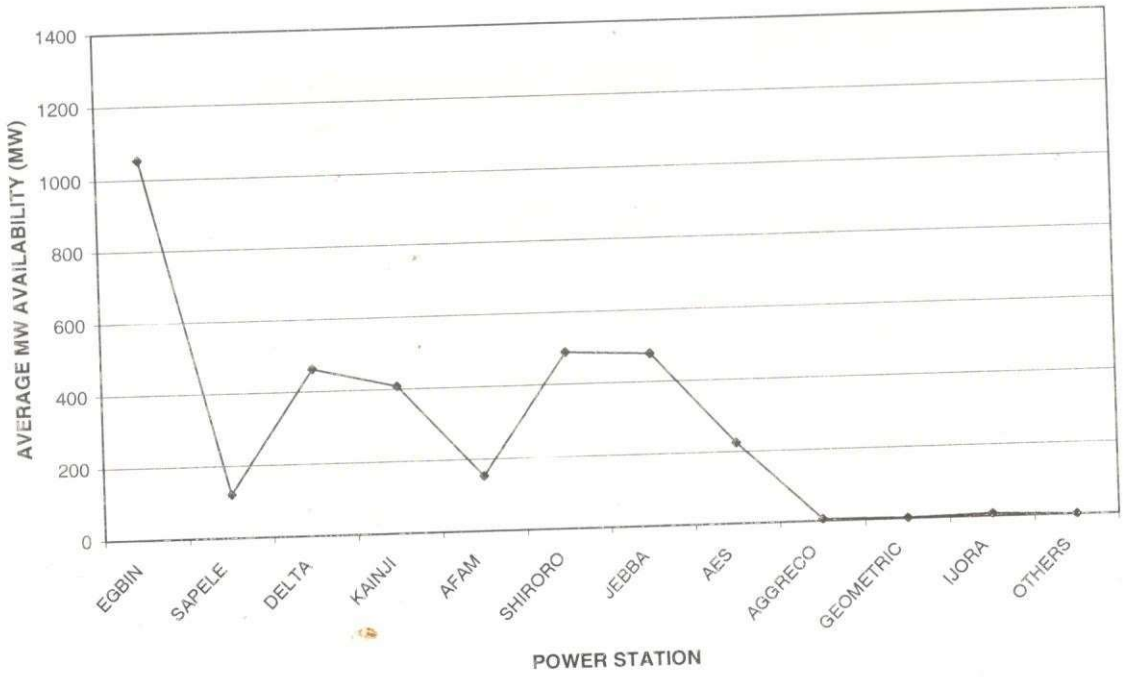

Figure 6: POWER STATIONS AVERAGE MW AVAILABILITY JANUARY – DECEMBER 2004

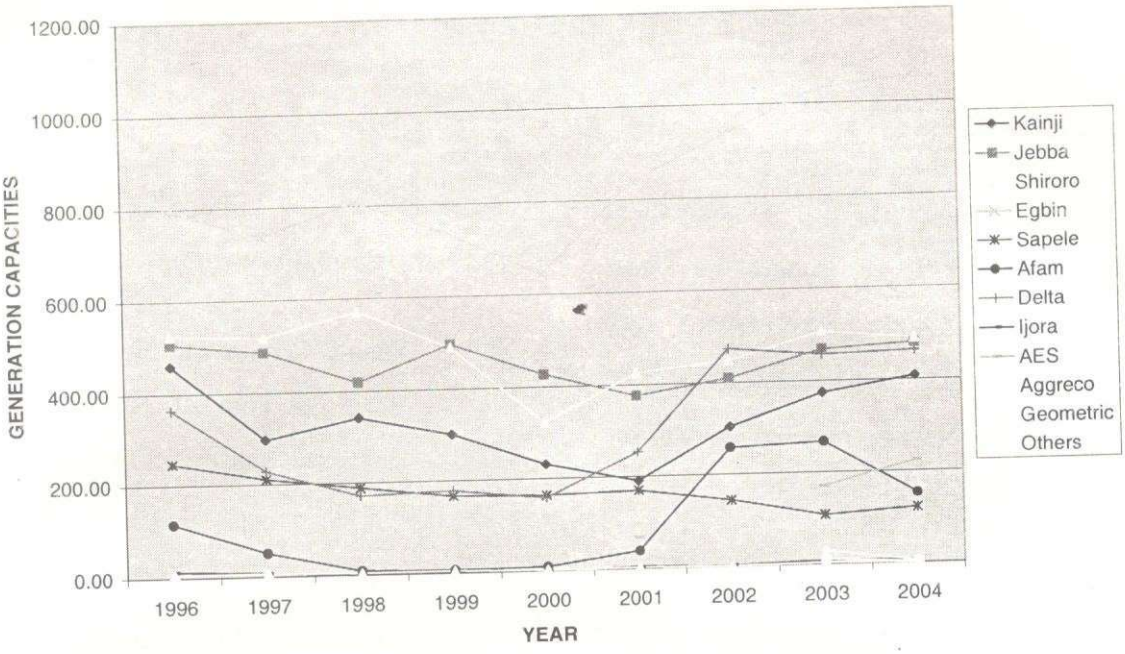

Figure 7: SUMMARY OF GENERATION AVALABILLITY OF POWER STATION (1996-2004)

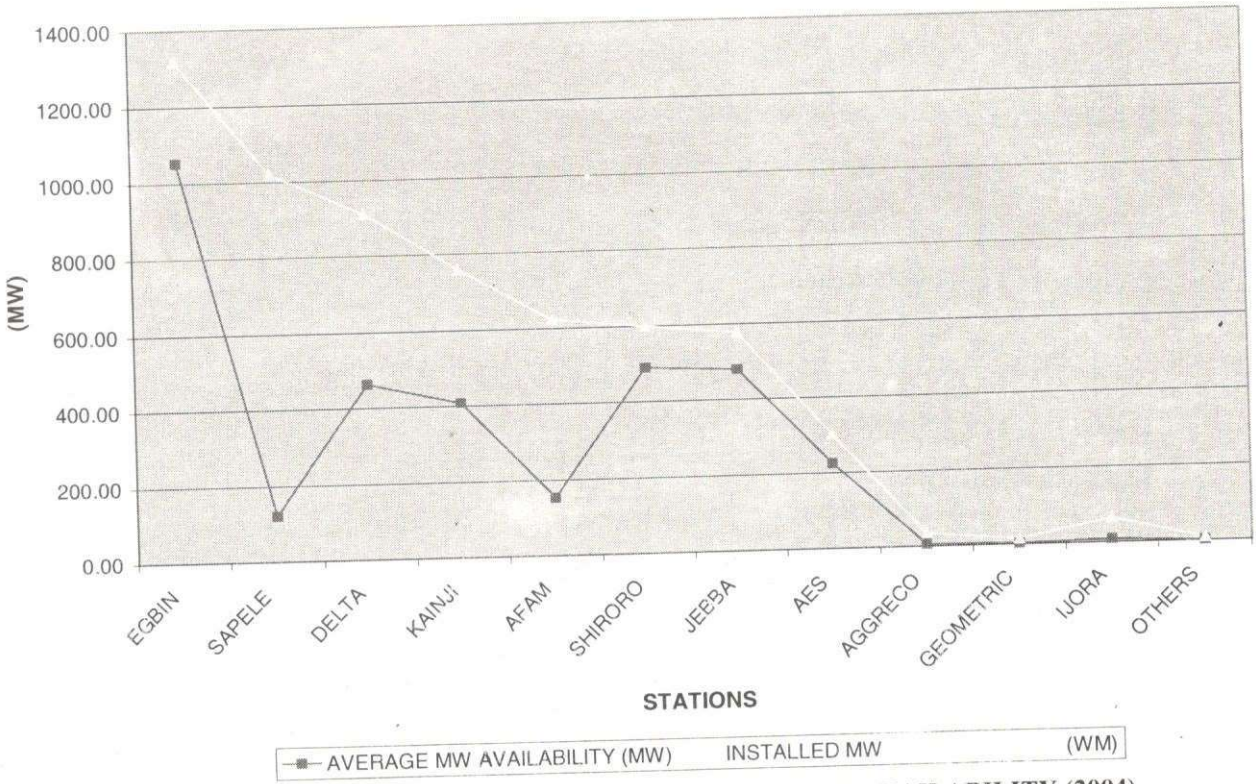

Figure 8: COMPARISON OF INSTALLED CAPACITY WITH AVAILABILITY (2004)

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