



IMPACT OF POWER GENERATION STATUS IN NIGERIA ON SUSTAINABLE DEVELOPMENT

ANTHONY C. NNAJI-Department of Electrical and Electronics Engineering, Enugu State University of Science and Technology, Enugu State Nigeria.

ABSTRACT: *Economic emancipation, rapid development and industrialization can only be realized upon a solid and robust energy sector. The current power generation status in Nigeria leaves much to be desired being below 4,000MW to provide the energy needs of over 140 million people. This paper critically analyzes the impact of this inadequate supply on the social, economic and industrial sectors. The cost of living, mortality rates, cost of production, pollution are some of the effects of the poor energy status of the country. The causal factors to the energy crisis are largely man made since Nigeria is blessed with enormous human and material resources to ensure a robust and stable energy sector to power her aspirations for industrialization and technological advancement. For Nigeria to meet the Millennium Development Goals (MDGs) and National Economic Empowerment and Development Strategy (NEEDS) target, adequate attention must thus be given to this ailing sector of the economy. The provision of a robust energy sector in Nigeria must therefore go beyond rhetoric to a purpose driven action toward harnessing the rich energy resources in the country for power generation.*

KEYWORDS: *Sustainable development, Energy status, Renewable energy sources, Fossil fuels, Economic impact, Power generation.*

INTRODUCTION

Energy is needed whenever work is required to be done. Power is said to be the rate at which this energy is expended or the rate at which work is done. Thus the relevance of energy to the socio-economic development of any country cannot be overemphasized. It is in fact the wheel that drives sustainable and robust economic development. Sustainable economies of the world have developed over the years a robust and thriving power sector to drive its ambition and quest for industrialization and technological advancement. Nigeria is the most populous Black Country in the world with an enormous work force and material



resources to meet her aspirations of industrialization. The material resource base for power generation in Nigeria is broadly categorized into conventional and non-conventional energy sources. The conventional energy sources namely; coal, fuel oil and gas have been estimated to be about; crude oil reserve estimated at 37.2 billion barrels, natural gas reserve estimated at 197 trillion cubic feet while coal reserve is estimated at 2.75 billion metric tons [1] on the one hand. These fossil fuels contribute over 75% of total world energy requirements. Non-conventional energy sources on the other, also called renewable energy sources such as; solar, wind, geothermal, small hydro, biomass and tidal waves are found to be generously distributed across the country though unevenly. These renewable sources of energy and their estimates are [2];

- Solar radiation - estimated at $3.5-7.0\text{KWh}/\text{m}^3/\text{day}$
- Wind energy - estimated at 150,000 *Terrajoules/annum*
- Geothermal energy - no estimate for this currently exists known to the author
- Biomass energy - estimated at 144 *million tons per annum*
- Nuclear energy - no estimate for this currently exists known to the author.

In view of these estimates, the country has within her all she needs to transform the energy sector for sustainable development. However the level of development and diversification of the power sector has been a big clog on the wheels of economic and technological advancement in the country. This is attested to by the fact that the amount of power generated to meet energy requirement of the nation is still below 4,000MW. The current energy crisis situation in Nigeria has continued to nose-dive to a critical situations with increasing infrastructural deterioration to unacceptable levels. This is in spite of the fact that the country is endowed with enormous human and natural resources for energy generation and sustainability. For Nigeria to meet the Millennium Development Goals (MDGs) and National Economic Empowerment and Development Strategy (NEEDS) target, adequate attention must thus be given to this ailing sector of the economy.

The outline of the paper is as follows; in section II Nigeria's energy situation is described in terms of her power generation capacity against her energy needs. The impact of this low



level of power generation on the sustainable economic development of the country is analyzed in section

III, while section IV centered on discussion. Finally section V contains the conclusion.

Table I

A List of Power Plants in Nigeria with their Installed and Generating Capacities

| Site name | Type | Installed capacity (MW) | Available capacity (MW) | Number of units |
|-------------|---------|-------------------------|-------------------------|-----------------|
| Egbim | Thermal | 1320 | 650 | 6 |
| Shiroro | Hydro | 600 | 450 | 6 |
| Ughelli | Thermal | 812 | 320 | 20 |
| Kainji | Hydro | 760 | 450 | 12 |
| Sapele | Thermal | 1020 | 63 | 10 |
| Afam | Thermal | 980 | - | 20 |
| Afam VI | Thermal | 650 | 450 | 3 |
| Jebba | Hydro | 540 | 482 | 6 |
| Geregu | Thermal | 440 | 92 | - |
| Omotosho | Thermal | 304 | 35 | - |
| Olorunsogo | Thermal | 304 | - | - |
| AES | Thermal | 270 | - | 5 |
| Okpai | Thermal | 450 | 361 | 5 |
| Omoku | Thermal | 150 | 60 | - |
| Trans-Amadi | Thermal | 136 | - | - |
| PGeometric | Thermal | 140 | 140 | - |
| Total | - | 8,876 | 3,653 | 93 |

Current Power Generation Status in Nigeria

Despite the enormous energy resource deposits in Nigeria and the potential for meeting her energy demand, the combined installed capacity of all the power plants in the country stands at about 9,000MW as at Dec 2009. Of this capacity the generated power is less than



4,00MW due to the average utilization factor of 41%. In table I [3], a summary of the installed and available electric energy at Nigeria's power generating plants is presented. The total power available for distribution from the table to a teeming population with energy needs estimate of about 10,000MW is less than 2,500MW due to transmission and distribution losses of between 30%-35% [4] [5].

Today more than 40% of Nigerians live in the rural areas without access to electricity supply. For those in the cities and areas with electricity, the supply is so epileptic and erratic lasting on average less than 8 hours per day [6]. Economists have long established that increased provision and utilization of energy services is part and parcel of economic development. It has been shown in [7] that the electricity demand in Nigeria far outweighs its supply. The country is thus faced with an acute shortage of electricity supply to power her aspirations for industrial transformation notwithstanding the availability of vast resources for power generation.

Table II

A Statistics of Current Power Generating Capacity of Some Countries and Their Per Capita Energy Capacity

| Country | population (millions) | power generating capacity (MW) | per capita power capacity | Country's GDP (billions) |
|---------|-----------------------|--------------------------------|---------------------------|--------------------------|
| USA | 293.6 | 848,300 (yr 2002) | 2,889.3 | 11,750 |
| Germany | 82.6 | 115,000 (yr 2002) | 1,392.25 | 2,362 |
| U.K. | 59.7 | 76,300 (yr 2002) | 1,265.25 | 1,782 |
| S.A. | 42.7 | 44,650 | 1,046.7 | 491.4 |
| Brazil | 179.1 | 86,020 | 480.3 | - |
| China | 1,300.1 | 338,300 | 260.0 | 7,262 |
| India | 1,086 | 115,520 | 106.31 | 3,319 |
| Ghana | 20.7 | 1,762 | 85.12 | 48.27 |
| Nigeria | 140 | 4,000 | 28.57 | 125.7 |

The level of power generated to meet demand has not been commensurate with the increasing population.



Nigeria's electric power generation capacity grew by 10% from 1985 to 2000. However, when compared to other developing economies of the world, this is grossly inadequate for sustainable development. For instance in the same time Vietnam grew by 332%, Iran 142%, Indonesia 237%, Malaysia 243% and 205% in South Korea [8].

This sorry scenario created by the limited scarce resources (fossils) used to generate power has led to energy crisis situation due to critical shortage in supply to meet demand. Because of this Nigeria's energy capacity per capita is very low in the light of what is obtainable globally. Table II captures this vividly according to [9]. The per capita energy and gross domestic product are indices used to measure the economic wellbeing of a country and her people [10] and this figures are very low for Nigeria [11]. Little wonder why over 70% of the population live below the poverty line with less than \$2 per day [12].

In its bid to tackle the present precarious energy generation in Nigeria, the present administration re-injected funds into ongoing and new power projects in various parts of the nation through the National Integrated Power Project (NIPP) initiative. As a result some new power generating plants are underway which when completed will help boost energy generation in the country. Table III lists some of these power projects, their locations and capacity [13], [14].

Table III

A Summary of Ongoing Power Plants Projects in Nigeria

| S/n | Name (Location) | Installed capacity (MW) phase 1 | Installed capacity (MW) phase 2 |
|-----|-----------------|---------------------------------|---------------------------------|
| 1 | Calabar | 561 | - |
| 2 | Ihovbo (Benin) | 451 | - |
| 3 | Sapele | 451 | - |
| 4 | Egbema | 338 | - |
| 5 | Gbarain | 225 | - |
| 6 | Omoku-B | 230 | - |
| 7 | Ibom-power | 193 | 450 |
| 8 | Geregu | 414 | 414 |
| 9 | Olorunshogo | 335 | 754 |



| | | | |
|----|-----------------------|------|------|
| 10 | Alaoji | 504 | 1000 |
| 11 | Omotosho | 335 | 754 |
| 12 | Okpai | - | 450 |
| 13 | Eket (Mobil JV) | 500 | - |
| 14 | Obite (Totalfina Elf) | 450 | - |
| 15 | Ijede (Chevron) | 250 | 800 |
| 16 | Mambilla | 2600 | - |
| | Total | 7837 | 4622 |

This definitely is a step in the right direction with the hope that these projects would not be abandoned before completion.

Impact of the Short Supply on the Economy

The impact of the present status of power generation and consumption in Nigeria could be divided into 3 broad areas namely; economic, social and industrial. These are further analyzed in this section under the following sub headings.

- High cost of living

It has been estimated that about 60 million Nigerians own personal power generating sets to meet their energy demand, while the same number of people spend a staggering NGN 1.56 trillion (\$13.35 billion) to fuel them annually [15]. The energy status has raised the cost of transportation and importation of education and medical equipment with leading to increased cost of accessing good education, Medicare, portable water supply, food, consumables and beverages. This high cost is the result of low and expensive supply of power required to boost the relevant sectors. Due to the prohibitive cost of accessing adequate Medicare, child, infant mortality rate is at an all-time high in the country. The average cost of good education has soared so much in respect to the income of the average Nigerian. Over 70% of Nigerians have little or no access to standard education since this percentage live below one dollar per day. This is



attested to by the number of children of school age involved in petty trading and street hawking. This sorry state promotes child trafficking, prostitution, armed robbery, and corruption in its multi-faceted form.

- Unemployment

Mass migration of multinational companies in the manufacturing and services sector to other neighboring countries due to the failure in the power sector provide acceptable levels of supply to drive manufacturing. This mass migration has led to unprecedented levels of unemployment, mis-employment and the likes. This thus has led to a drastic reduction in the Nation's Gross Domestic Product (GDP). A great number of Nigerians are unemployed and greater number are mis-employed

- Irregular supply of power for industrial processes

The low level power supply had led to load shedding, incessant black out and brown outs. This leads to the dependence on self-generated power supply using generating sets. The manufacturing sector experienced about 316 outages in 2004, 398 in 2005 and 452 in 2006 and the trend keeps worsening over the years according to [12]. The major operators in the country's real sector represented by the Manufacturers Association of Nigeria (MAN) and the National Association of Small and Medium Scale Industries have estimated their members spend an average of NGN1.8 billion on power generation weekly and that the major challenge facing the sector in Nigeria is lack of adequate power supply [14]. Big manufacturing concerns such as Procter & Gamble, Coca-Cola, Lever brothers, NB plc have resorted to the use of self-generating machines to provide 100% operations during critical processes. This leads to upward push on the overall cost of production thereby denying them the competitive advantage they will enjoy in meeting local demand and a firm basis for competing in the global market. Irregular electricity supply cripples industrial processes and also causes problems in the agricultural sector as most irrigation lines and mechanization are powered by electricity [16], [17].

- Environmental hazards and pollution

In order to seek alternative means of meeting their energy needs; most have resorted to the use fuel wood, liquefied natural gas, and kerosene in place of electric power to



meet their domestic energy requirement. These actions lead to deforestation and air pollution. Deforestation in turn leads to flooding, soil erosion, desertification and loss of biodiversity. These situations abound in various parts of the country, urban and rural areas alike and pose a source of worry to the present government.

- Emission of greenhouse gases (Climate change)

The use of conventional energy sources such as coal, fuel oil and gas, generally called fossil fuels are the major contributors to the challenging environmental issues world over which is the emission of greenhouse gases and other hazardous substances into the environment. The use of personal generating sets in Nigeria is a key contributor to greenhouse gas emissions in the country due to the enormous amount of personal generator sets in the country [12]. This rise in energy requirements and therefore generation also negatively affects the cost of fossil fuel prices such as fuel oil, natural gas and coal due to the limited nature of these fossil fuels. The greenhouse gases are those gases such as carbon dioxide, which absorb and emit radiant energy from the sun within the thermal infrared range and usually lead to greenhouse effect. These emissions thus lead primarily to global warming with its negative impact on the environment and biodiversity [18].

- High cost of production

The inadequate level of power generation in the country has constrained the competitiveness of the manufacturing and industrial sectors of the economy and has imposed significant costs and distortions on the economy [19]. Because of the irregular power supply and the increasing need for sustained production, some Nigerian manufacturers have resorted to the use of diesel and gas for their energy needs. Estimates suggest that between 8 and 14 GW of decentralized diesel generator capacity is currently installed in the country. Over 80% of the companies in Nigeria own or share a generator and about 50% of their total electricity demand is covered by these private generators.

The impact of low energy consumption level in Nigeria due largely to the poor level of power generation in the country has been one major issue which has slowed down to a grinding halt the developmental efforts being made in other areas. It is the sincere believe



of the author that soon as this critical sector of the economy is got right, other sectors will naturally fall in sync.

Table IV

A Summary of Major Causal Factors to Poor Energy Generation in Nigeria

| S/n | Factor | Weighting (1 - 10) |
|-----|-------------------------------|--------------------|
| 1 | Insufficient funding | 8 |
| 2 | Poor Maintenance Planning | 10 |
| 3 | Poor Spare parts supply | 10 |
| 4 | Top Management attitude | 8 |
| 5 | Lack of manpower training | 6 |
| 6 | Attitude of government | 9 |
| 7 | Attitude of contractors | 7 |
| 8 | Equipment vandalization | 5 |
| 9 | Climate change | 5 |
| 10 | Insufficient gas supply | 9 |
| 11 | Wrong location | 2 |
| 12 | Lack of policy continuity | 7 |
| 13 | Limited Automation | 9 |
| 14 | Lack of energy mix technology | 6 |

DISCUSSION

Many factors have been identified as contributing to the present poor energy capacity in Nigeria. According to [3], some of these factors and their weighting on a scale of 1 - 10 with 1 being lowest and 10 highest impact is captured in table IV. From these factors and their respective weighting, it is clear that some factors impact more than the others and as such demand greater level of attention. High impact factors such as Poor maintenance planning, poor spare parts, limited automation, inadequate gas supply and attitude of government



should be given due attention. All these factors are mostly human related and may not necessarily be capital involving. Changing the present energy situation is challenging in view of the current state of affairs in the energy sector and corruption in the leadership. Much capital investment is required to move the sector forward and this cannot be shouldered by the government alone. Private sector participation must be sought and encouraged by way of adequate and comprehensive policy document on energy with emphasis on diversification of the sector. Another issue to be addressed by the government is security of lives and investment given the instability that has characterized the oil rich region of the country. This instability has led to vandalization of supply pipelines for oil and gas to power the various power plants scattered all over the country.

V. CONCLUSION

A rapidly growing and robust energy sector is a necessity for the economic advancement, development and industrialization of Nigeria. This will directly lead to the transformation of the economic fortunes of the country and sustainable development. There has been many socioeconomic problems due to the low level of power generation in Nigeria. This paper therefore analytically studied the impact both to human lives and economic activities. From the study it is pertinent that the government of the day should make robust energy development, expansion and diversification of the current energy dynamics a priority. This will in turn lead to the injection of the much needed power to drive other sectors of the economy.

REFERENCES

- [1] World energy review. Bp Statistics of World Energy. www.bp.com. Accessed on 12/08/2012.
- [2] Ibitoye, F. and Adenikinju, A., (2007). Future Demand for Electricity in Nigeria. *Applied Energy* 84. pp 492-504
- [3] Emovon, I., Kareem, B. & Adeyeri, M. K., (2011) April. International Conference of Nigerian Association of Energy Economics, (NAEE), Abuja.
- [4] Ikeme, J. and Obas, J. E., (2005). Nigeria's Electric Power Sector Reform: The Key Objectives. *Energy Policy*, 33, pp1213-1221.



- [5] Kola, S. and David, M. O., (2008). Privatization and trends of Aggregate consumption of electricity in Nigeria: An Empirical Analysis. *African Journal of Accounting, Finance and Banking research*, Vol.3 (3) pp 21-32
- [6] Okoro, O. I., and Chikuni, E. (2007). Power Sector Reforms in Nigeria: Opportunities and Challenges. *Journal of Energy in Southern Africa*, 18 (3), 52-57
- [7] Ajao, K. R., Ajimotokan, H. A., Popoola, V. T. and Akande, H. F. (2009). Electric Energy Supply in Nigeria, Decentralised Energy Approach. *Cogeneration and Distribution Journal*. Vol.24, (4)
- [8] Maigida, S. (2008). Power Sector Infrastructural Development by 2020: Issues and Challenges. Paper Presented at the 1st International Conference of NAEE/IAEE.
- [9] Ibidapo-Obe, O. and Ajibola, O. O. E., (2011) August. Towards a Renewable Energy Development for Rural Power Sufficiency. *International Conference in Engineering and Technology*.
- [10] Sesan, T. (2008) Status of Renewable Energy Policy and Implementation in Nigeria; www.gbengasesan.com/temidocs/REPStatusNigeria.pdf.
- [11] Okafor, E. E., (2008). Development Crisis of Power Supply and Implications for Industrial Sector in Nigeria. *Journal of Studies of Tribes and Tribals*, 6 (2): 83-92
- [12] Iwayemi, A. (2008). Nigeria's Dual Energy Problem: Policy Issues and Challenges. *Association for Energy Economics*, Fourth Quarter 17-21
- [13] Makoju, J. O. (2007). A Presentation to the Presidency on Power Sector Status: Issues and Way Forward. *International Journal of Engineering and Advanced Technology*, 2 (3), 230-287
- [14] Sambo, A. S., Garba, B., Zarma, I. H., and Gaji, M. M., (2009). Electricity Generation and the Present Challenges in Nigerian Power Sector. *Energy Commission of Nigeria*. Abuja, Nigeria
- [15] Sanusi, S. L. (2010). Funding of Power projects: The Role of the Central Bank of Nigeria. *Conference of the National Association of Energy Correspondents (NAEC)*.
- [16] Aliyu, A., Ramli, A. & Saleh, M., (2013). Nigeria electricity crisis: Power generation capacity expansion and environment alarmifications. *Energy*, 61(8), pp. 354-367.



- [17]Kaseke, N. & Hosking, S., (2013). Sub-Saharan Africa Electricity Supply Inadequacy: Implications. s.l., Organization for Social Science Research in Eastern and Southern Africa, pp. 113-132.
- [18]Botzen, W.J.W., Gowdy, J.M., van den Bergh, J.C., (2008). Cumulative CO2 Emissions: Shifting International Responsibilities for Climate Debt. *Climate Policy*. Vol. 8, p.569-576. doi:10.3763/cpol.2008.0539.
- [19]Adenikinju, A. (2008). Efficiency of the Energy Sector and its Impact on the Competitiveness of the Nigerian Economy. *International Association for Energy Economics* Vol. 27
- [20]Akpan, I., (2005). Deregulating the Nigerian Power Sector: The Case of Privatization. *South-South Journal of Culture and Development*, 7 (1), 87-108.