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Review

Revitalization of the Nigerian coal mining industry to expand the power generation needs of Nigeria

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ABSTRACT

A nation with rapidly growing population requires more electrical power to encourage industrialization and boost its own economy. The economic viability of coal has been comprehensively explored and the need for its revitalization in the power generation to improve on industrialization and thus the economy of Nigeria emphasized. Records and research have successfully shown that the revitalization of coal is the way forward to improve on the power generation challenges in the country. Relevance of coal is not only limited to the generation of electric power only, other areas have is hereby further discussed.

Keywords: Revitalization, Nigeria, Kogi, Coal, Power Generation.

INTRODUCTION

Nigeria is a country located on the latitude 10°N longitude 8°E in western part of the continent of Africa. As one of the most blessed nation in the world, Nigeria is naturally gifted with many resources some of which are inexhaustible. One of the natural resources found in this gifted country is the *coal*.

Coal have been the world's most abundant and widely distributed fossil fuel with reserves for all types of coal estimated to be about 990 billion tonnes, enough for a period of 150 years at current consumption (AGO 2000). The need for energy, together with the economics of producing and supplying that energy to the end user, are central considerations in power plant investment decisions and operating strategies (Henderson 2003). Coal is the least costly and most accessible fuel for some of the most dynamic developing economies. Its use in power plants accounts for over 28% of global power consumption (IEA, 2008). As one of natural resources that could boost the economy of a nation, coal has attracted the interest of intellectuals to device technology that could be adopted for its extraction and production with a view to power generation that could deliver fuel savings of 50% (IEA, 2008).

Need To Revitalize Coal Energy Generation

Electric generation in Nigeria has always been from hydro and thermal sources. The thermal power plants were fired predominantly with coal at the on -set, which was later followed by oil and gas. Electricity generation from coal in Nigeria started in the late 18th century, around 1896 (Ogunsola, 1990). In 1912 however, there was a changeover to diesel-fired power plants resulting from discovery of oil and neglect of the earlier. Improvements in the efficiency of coal-fired plants in 1920 brought increased coal–fired power plant development, resulting in the establishment of more coal-fired power plants built in various part of the country e.g Iddo power plant located in the south west part of the country; and subsequently in other geographical zones within the country (Mkpadi 1985).

The use of coal for power generation was later 'swept under the carpet' and replaced with crude oil products in the late 50's and 60's with the advent of clean-burning oil fired boilers which occurred soon after crude oil extraction commenced. The use of natural gas for power generation in Nigeria is relatively recent and has been growing since it started. In 1981, gas-fired power stations accounted for about 62 percent of the total installed capacity.

With the increments so far recorded in power generation in Nigeria, The output growth rate of electric energy in Nigeria from 1993 to 1998 was 2.1 percent per year to the tone of 24,180 GWH in 2004 (Behre Dolbear, 2006).

With the rapid increase recorded in Nigerian population, industrial revolution and economic activities and the then National Electric Power Authority (NEPA) and now Power Holding Company of Nigeria (PHCN) was plagued with inadequate funding and under capitalization, inappropriate capital structure, excessive executive interference, and sub-optimal decision-making and planning; consequently, the facilities deteriorated, thereby resulting in reduced and unreliable power generation capacity and transmission and distribution. In the late 2005, the Power Holding Company of Nigeria (PHCN) operated and maintained power-generating stations with a total installed capacity of about 3.96 GW (Behre Dolbear, 2006).

In a bit to improve power generation, privatization of the energy sector was initiated through the Electric Power Sector Reform Act of 2005. The Power Holding Company of Nigeria (PHCN) is being saddled with the burden of generation, transmission and distribution of electricity; Task that has become burdensome for the company to cope with even with numerous government interventions and the on-going reforms in the power sector. Meanwhile, several Independent Power Producers (IPPs) are already in operation in some part of the country. Not all these have been able to make reasonable impact on power generation, hence the need to revitalize coal power generation. The reason for this limitation could be attributed to the neglect of the use of coal in the generation of power.

The exploitation of coal for electricity generation and its subsequent production for domestic and industrial heating will bring about a number of benefits, which includes:

i. increase and more reliable electricity supply
ii. lower cost of electrical energy;
iii. expanded industrialization of the economy;
iv. increased employment and human resources development
v. increased capacity utilization of existing industries
vi. increased national income through taxes;
vii. reduced deforestation and prevention of desert encroachment in the northern parts of the Country.

Apart from power generation, there is also a significant potential domestic demand for coal to replace wood for cooking, domestic and industrial heating. The use of wood by the country's growing population is causing increasingly rapid deforestation in many parts of the country.

Nigerian Coal Resources

Nigeria has extensive coal resource with inferred reserves estimated at ranging from 1.5 billion metric tonnes to 2.75 billion metric tonnes (Nigerian Coal Corporation, 2004; U.S. Environmental Protection Agency, 2007) and proven reserves of 639 million tonnes, (Ogunsola, 1990; Nigerian Coal Corporation, 2007). Studies conducted by Behre Dolbear (2005, 2008) for the Nigerian Ministry of Solid Minerals Development (MSMD) indicates that the Nigerian coal resources are far larger than previously reported. Nigeria's coal resources are not being fully explored or even marginally developed despite its long history. Nigerian coals are of cretaceous or early tertiary age and are mostly located in the eastern part of the country. They are mostly lignite and sub-bituminous, with some deposits of high volatile bituminous (Ogunsola, 1990). Nigeria has more than 1.5 billion metric tons of sub-bituminous to bituminous coals and unquantifiable lignite deposits (NCC, 2007).

Coal occurs in several areas in Nigeria and ranges from bituminous to lignite. The coal deposits of the Anambra Basin, located in South-Eastern Nigeria, appear to contain the largest and most economically viable coal resources. This basin covers an area of approximately 1.5 million hectares and is constrained by the Niger River on the west, the Benue River on the north and the Enugu Escarpment on the east. The coal is predominantly in one seam that outcrops along the eastern side of the basin at the base of the Enugu Escarpment and dips gently toward the center of the basin.

This paper has subdivided the Anambra Coal Basin into three major coal-mining districts, focusing on these three because they have been explored to a greater degree than the others. These have been defined as the Kogi, Benue (Orupka-Ezimo) and Enugu Coal Districts.

The Kogi Coal District, covering 225,000 hectares of the Anambra Coal Basin, lies on the North-Eastern side of the basin. Two areas within the district have been explored to a limited degree. The more northern of the two areas, Ogboyaga, has the greatest amount of available drill data, where 27 holes have been drilled and cored and 15 separate measurements have been taken of outcrops of the main coal seam in stream drainages. The other area of interest is Okaba, the site of a small idle surface mine. In Okaba several core holes have been drilled, all of which intersected the main coal seam. No outcrop samples have been reported for this area. A total of 100 million tonnes of demonstrated coal have been estimated to underlie 2,770 hectares in the Okaba area and an additional 435 million tonnes of non-reportable coal resource are projected to the west of existing drilling. In total the Kogi Coal District is estimated to have a Demonstrated Coal Resource of 223 million tonnes averaging 3.6 meters thick, which underlies 8,900 hectares, or 4 percent of the District. The total nonreportable resources are 600 million tones (Behre Dolbear, 2006).

The Benue Coal District covering 175,000 hectare of the

Table 1. Summary of Reportable and Non-Reportable Coal Resources Kogi, Benue (Orukpa-Ezinmo), and Enugu Districts (Million Tones)

Reportable Tonnes				Non-Reportable Tonnes			
Area	Measured	Indicated	Total Demonstrated	Inferred	Hypothetical	Total	Total Resource
Ogboyoga	56	67	123	83	82	165	288
Okaba	45	55	100	191	244	435	535
Orukpa	40	41	81	88	29	117	198
Ezimo	17	26	43	112	151	263	306
Enugu			49	111		111	160
Total			396	585	506	1,091	1,487

Source: MMSD Report 2010

Table 2. Approximations of coal quality by area (A.R. Basis)

Area	**Moisture** (%)	**Ash** (%)	**Sulphur** (%)	**Heating value**	
				Btu/lb.	Kcal/kg
Ogboyoga	13.50	8.00	0.58	9,930	5,520
Okaba	10.30	9.30	0.65	10,280	5,710
Orupka	11.80	11.20	0.40	9,990	5,550
Ezimo	10.90	6.40	0.50	10,900	6,050
Enugu	7.60	6.70	0.93	11,900	6,610

***Source**: MMSD Report 2010*

coal basin, is immediately south of the Kogi District along the eastern outcrop of the Anambra Basin. It also has two areas of interest. The more northern of the two, Orukpa, includes a small idle surface mine and a total of 11 drill holes. Six coal outcroppings have also been measured in streams in the area. Based on these data, Behre Dolbear estimates that a reportable coal resource of 81 million tonnes. Another 117 million tonnes of non-reportable coal is projected to exist west of the existing drilling. The average coal thickness is 3.1 meters. Immediately south of the Orukpa area is the Ezimo area. This area has limited exploration, with only four drill holes penetrating the main coal seam. Ten coal outcroppings have also been measured, not all of which have exposed the entire seam. Based upon this limited data, a total of 43 million tonnes of demonstrated coal resource have been projected for the Ezimo area. An additional 263 million tonnes of non-reportable coal resource is projected to exist west of the existing drilling. The average coal thickness in this area is also 3.1 meters. In total, the Benue District (Orukpa-Ezimo) is estimated to have a Demonstrated Coal Resource of 124 million tonnes, which underlies 4,700 hectares, or 3 percent of the District. The total non-reportable resources are 380 million tones (Behre Dolbear, 2006).

The Enugu Coal District, covering 270,000 hectares of the coal basin, is centered around Enugu City, south of the Benue District. It has supported the largest amount of commercial mining in the past. In addition to two underground mines, there are a total of 36 drill holes drilled in the area. Previous studies have estimated the demonstrated coal resource to be 49 million tonnes averaging 2.2 meters thick. An additional 111 million non-reportable tonnes in places coal are inferred to exist west of the old mine workings (Behre Dolbear, 2006)

Within the areas of these three districts where sufficient drilling exists to make reasonable estimates of in-place coal resources, a total of 396 million metric tonnes was estimated. An additional 1,091 million tonnes of inferred and hypothetical coal resources have been delineated in these three districts. The entire currently defined coal resource for the areas studied is 1,487 million tonnes. The coal seam thickness averages 2.2 meters throughout the area from Enugu north to Ogboyoga. The remaining districts are essentially unexplored (Behre Dolbear, 2006).

Coal in the areas studied is considered an excellent thermal coal for fueling coal-fired electrical generating plants, or for other industrial use there is enough information to indicate that there is a high probability that each of these Districts can support a significant coal-fired generating plant. The Coal Resource estimates and approximate coal quality for the areas studied are summarized in the following tables:

CONCLUSION

In this study, the economic viability of coal has been comprehensively explored and the need for its revitalization in the power generation to improve on industrialization and thus the economy of Nigeria emphasized. Records and research have successfully shown that the revitalization of coal is the way forward.

RECOMMENDATION

Nigeria is to revitalize the coal mining industry and expand power generation by attracting foreign companies to develop these large coal resources and construct coal-fired generating plants that will connect to the Country's electrical distribution grid. Policy makers must reflect on what steps are now needed to improve the overall efficiency of power generation from coal. Further exploration is required by the prospective investors to prove those reserves and develop confidence required to support investments in major mines and generating facilities. The government should also undertake proper exploration work to determine the exact amount of mineable deposit of coal in Nigeria.

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