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Economic Potential and Benefits of Sawdust in Nigeria

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Abstract

At present, the main conventional source of energy used all over the world is the fossil fuels which are non-renewable and hence their deposits will eventually be exhausted. Wood is one of the oldest fuel sources known to man. Research have shown that about 80 million cubic metres, equivalent to 43.4 x 10^9 kg (or 43.4 million tonnes) of fuel wood with an average daily consumption ranging from 0.5- 1.0 kg of dry fuel wood per person is being consumed in the country annually for cooking and other domestic heating purposes. This study discusses the quantity of wood waste generated in saw mills in Nigeria. The environmental implications of improper disposal of sawdust arising from sawmills are also analyzed. Essentially, the economic potential of sawdust is discussed. It was revealed that saw dust waste left at the saw mills causes aesthetic problems while abandonment along the road side causes air pollution as a result of wind which often blows and suspends the wood dusts into the atmosphere.

Keywords: Energy, Waste, Saw dust, Pollution, Non-renewable energy, wood

1. Introduction

The According to (Akinola, 2012; Orhorhoro et al., 2017), energy is one of the indispensable factors for continuous development and economic growth. The demand for energy is increasing rapidly in the developed and developing countries due to automation, industrialization and urbanization (Hasanuzzaman et al., 2008). The growing population and technological developments have shown that the present sources of energy in use are not adequate (Hasanuzzaman et al., 2008). It was also reported that the world population has increased at

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an explosive rate from 1.65 billion to over 6 billion people in the 20th century, and will continue to increase as stated in **(**BP Statistical Review of World Energy, 2003).

Eckholm et al. (1984) reported that virtually all the major sectors of the economy such as industries, commercial institutions, transportation and residential homes have been designed for and have grown on an unrestrained access to cheap energy, which in this content refers to 'affordable and unfailing energy supply'. However, energy from fossil fuels and other non- renewable sources has become so expensive quickly that our patterns of consumption have had little time to adapt. The recent happenings in the energy sector of Nigeria are a pointer in this direction.

Wood is one of the oldest fuel sources known to man. Its use is undergoing something of a renaissance, with ever greater awareness of the need to reduce our reliance on fossil fuels in favor of renewable alternatives, as an important element of tackling climate change. Fuel wood is the most widely used domestic renewable energy resource in rural Nigeria and especially by low income groups in the urban areas. Over the 1989-2000 period, fuel wood and charcoal constituted 32 and 40 percent of the total primary energy consumption with 39 million tonnes estimate in national demand in 2000 (Sambo, 2005). Fuel wood forms the largest percentage of the non-commercial energy (about 37.4 % of the total energy demand) and will continue to dominate the non-electricity energy needs for the majority of people in the country. Ohunakin (2010) reported that about 80 million cubic metres, equivalent to 43.4 x 109 kg (or 43.4 million tonnes) of fuel wood with an average daily consumption ranging from 0.5- 1.0 kg of dry fuel wood per person is being consumed in the country annually for cooking and domestic purposes. Eckholm et al. (1984) stated that the energy content of the fuel wood that is being used is (6.0 x 10 9MJ) out of which only between 5-12 % is the fraction that is gainfully utilized for cooking and other domestic uses.

Similarly, Milbrant (2007) stated that forest residues include wood wastes from logging and wood-processing activities. Logging residues are the unused portions of trees cut during logging operations and left in the woods. These include stumps, branches, leaves, off-cuts, and sawdust. wood processing residues, or primary mill residues, are composed of wood materials(such as discarded logs, bark, sawdust and shavings) generated at manufacturing plants – sawmill, veneer mill, plywood mill, or pulp mill- when round-wood are processed into primary wood products. Badejo (1995) reported that the quantity of wood waste generated in the saw mills is estimated at about 3.87 million m^3 of which saw dust accounts for about 20 %. According to him, the number of saw mills in Nigeria rose from over 500 in 1975 to 1200 in 1981. These mills are estimated to produce well over 1.7 million cubic metres of wood waste annually. Wood wastes abound in Nigeria owing to the activities of saw millers. The saw millers typically cut wood (logs) from the forest, transport them to their mills and saw the wood into lumbers of various dimensions. In the process, saw dust and other wood waste such as wood bark, slab, log-ends etc. are produced. And because of lack of better ways of handling these wood wastes, they are commonly disposed indiscriminately into the environment, which results to negative environmental impacts. Common disposal methods seen include heaping/abandonment at the mills, open air combustion, disposal along roadside and water bodies.

2. Quantity of Sawdust Generated in Nigeria

The forest industry in Nigeria is made up of the saw mill, wood based panels and the furniture industry. The performance of the various subsectors is discussed in the sub sections:

2.1 Sawmill Industries

According to Fuwape (1995) sawmill account for 93.32% of the total number of wood based industries in Nigeria. According to Ogunwusi and Jolaoso (2012), the installed capacity and capital utilization of sawmills in Nigeria rose from 8,831,750m^3 in 1988 to 15,793,188m^3 in 1992. It then decreased to 10,900,000m^3 in 1996 and subsequently increased to 14,684,000m^3 in 2002 and 11,734,000m^3 in 2010. Capacity utilization within these periods was 69,943, 600m^3, 6031, 922m^3 and 7069, 145m^3 3,800,000m^3 respectively. This represented 79%, 38%, 39% and 32% capacity utilization respectively. Total number of sawmills decreased from 1617 in 1990 to 910 in 1992. It rose to 1252 in 1996 and to 1259 in year 2002. In 2010, the number of sawmills in Nigeria stabilized at 1325. With an average recovery rate of between 45-55% as shown in Table 1, the waste generated in this subsector inform of bark, sawdust, trimming, split wood, planer shavings and sander dust in year 2010 alone was over 1,000,000m^3.

Table 1: Percentage Volume Recovery and Waste Generation in Selected Forest Industries (Ogunwusi, 2014)

Product/Waste	Sawmilling	Plywood Manufacture	Particle Board	Integrated Operation
Finished product	45-55	40-50	85-90	65-70
Finished product	50	47	90	68
Average	-	-	-	-
Residue/fuel	43	45	5	24
Losses	7	8	5	8
Total	100	100	100	100

Badejo, (1990) reported that a typical sawmill industry in Nigeria is characterized by small scale operators who mostly process timber with the CD series machine as shown in Figure 1.

Figure 1: A Typical Nigeria Sawmill

In a study on waste generated in some selected sawmills in Kajola Local Ggovernment Area of Oyo State, Kukogho et al., (2011) observed that two categories of wood waste were generated. These are those generated

within the wood based plants during the conversion process and those generated during timber harvesting and transporting. It was established that about 60% of the total harvested trees are left in the forest and the non-commercial species are subjected to slash and burn or merely left to rot in the forest (FAO, 2011). According to study by Ogunwsanwo (2011), the highest percentage of lumber recovery in the mills studied was 80.23% due to the fact that most of the selected logs were fairly large in girth while the lowest lumber recovery was 70.09% due to the fact that most of the selected logs where fairly small in girth and of different forms. He equally observed that logs size and shape to have direct impact on lumber recovery. Further analysis by Kukogho et al., (2001) indicated that there was no significant difference between the volume of sawdust and that of slabs in the sampled trees while there is significant difference between volume of sawdust and tree species sampled. This may indicate that less dense tree species may generate higher volume of sawdust. Figure 2 shows volume of sawdust produced in a typical Nigeria sawmill.

Figure 2: Sawdust produced from sawmill

Also in a similar study by Egbewole et al. (2011) on the technical performance efficiency of 27 selected sawmills using 243 logs obtained from 20 species of wood sourced from the South western Nigeria, the results indicated that the large diameter logs (> 55.01cm) had the highest mean lumber recovery of 54.48%, closely followed by medium sized logs (40.01-55cm) with 54.18% and small sized logs (<40cm) with 51.77%. Analysis of variance indicated that the influence of log diameter classes was significant on the % lumber recovery. The findings of G.W.V (1994) revealed that wood species, technology and head rig process machine used and operators have direct significant impact on the conversion efficiency obtained during log processing and consequently, the volume of wood waste generated.

2.2 Furniture Industries

According to Ogunwusi (2014), the capacity utilization of the furniture industry was 217,700m^2 in 1988. This increased to 250,714m^3 in 1992. In 2010, capacity utilization in the industry was 326,172m^3 of round log equivalent. More than 400 furniture companies of various sizes exist in the country. The shortfall in large furniture companies is made up by the numerous cottage and small scale furniture makers which numbers more than 10,000 outlets as reported in G.W.V (1994). This category of furniture makers usually operate in the informal sector and are found in the rural and urban areas where the middle and low income earners reside. Waste generation in the furniture industry varies from 35-45%. At the upper end of the range are the artisanal furniture makers who use crude implements and out-dated process technology.

In Nigeria, the conventional furniture industry uses simple technologies. They have low technical knowhow and low capital input. They are mostly made up of outfits with crude hand tools and equipment (RMRDC, 2003) resulting in poor quality products**.** The small scale furniture producers are technically inefficient as they

fall below efficiency level of 60% (Ako and Kuye, 2010). The implication is that the average furniture producer need about 88% cost saving device to become an efficient producer. Most of the small scale operators are more interested in quick profit rather than quality control and expansion (NACETEM, 2010). Other problems militating against adequate performance of operatives in the subsector are low level of demand (Arowosege, 2010) poor workmanship (G.W.V, 1994), and high level of poverty and long lifespan of furniture products. Others include the inefficiency of the ban on furniture importation due to high level of smuggling (Aku, 2010) paucity of skilled manpower and non-adherence to standard drying, preservative treatment and design procedures (G.W.V., 1994). These characteristics of the furniture industry lead to high level of wastage. The level of wastage in this subsector varies from 20-40% depending on operator's experience, processing methods and equipment employed.

2.3 Plywood Mills

G.W.V. (1994) stated that in 1988, the total installed capacity of plywood mills was 126,000m^3. This decreased to 106,000m^3 in 2002 and further to 96,000m^3 in 2010. Capacity utilization in this sub sector has also being fluctuating. It increased from 67,340m^3 in 1988 to 72,240m^3 in 1992. Since 1992, capacity utilization and number of industries operating within the subsector have been on decrease from 72,240m^3 in 1992 to 54,600m^3 in 1996 and 14,900m^3 and 10,250m^3 in 2002 and 2010 respectively. The number of plywood mills increased from 8 in 1988 to 1992 and increased to 10 in 1996. However, it decreased to 4 in 2010. With an average proportion of 45% waste generation, about 5,000m^3 of residues inform of bark, core, sawdust, Lilly pads, veneer clippings and waste, panel trims and sander dusts were generated by the plywood mills in 2010 alone. According to Kehinde ET AL. (2009), the extent of the problem caused by wood wastes in Nigeria is widespread. It was actually reported that 50% of the saw log is wasted during processing in Nigerian sawmills. Izekor and Kalu (2008) reported that about 20.64%, 10.28%, 7.3% and 6.31% comprise of slabs, saw dust, wane and bark respectively make up the total wood waste. And with about 2000 saw mills in the country, the total volume of wood waste sum up to 104,000m^3 per day. Using 312 working days in a year i.e. including Saturdays, as reported by Oluoti et al. (2014), the total volume of waste wood generated per annum is 32.45 million cubic meters, of which saw dust has a bulk density of 160 kg/m^3. It is therefore estimated that the total mass of waste wood generated in Nigerian sawmills is 5.2 million tonnes each year. As the demand for wood and its products increases, it is expected that the volume of wastes being generated would obviously increase. Similarly, it is estimated that Nigeria has sawdust resources of 1.8 million tonnes. This quantity is enormous (Sambo, 2009).

3. Environmental Effect of Wrong Disposal of Sawdust

One of the environmental problems facing cities and towns today is the improper disposal of the wastes being generated daily by the ever-increasing activities of sawmills. It is also obvious that waste generation is connected with everyday living: thus it cannot be avoided. With numerous attendant problems being caused by the lack of correct management of theses wastes, it is imperative that every effort be made not only to undertake proper management but also to put it into good use, as is the case in developed countries (Oluoti et al., 2014). Abandonment of saw dust at the saw mills causes aesthetic problems while abandonment along the road side causes air pollution as a result of wind which often blows and suspends the wood dusts into the atmosphere. This practice could cause respiratory problem in humans. The open air combustion of saw dust as shown in Figure 3 often causes air pollution with the release of carbon (IV) oxide (CO_2), smoke, NOx etc., and loss of potentially useful energy into the environment. Sawdust heaps are considered waste and therefore are indiscriminately incinerated, making a significant contribution to the greenhouse gas emissions.

Figure 3: Indiscriminate combustion of sawdust

Wood waste negatively impact the quality of the receiving waters with parameters such as dissolved oxygen, biochemical oxygen demand (BOD), phosphate, nitrate, transparency and conductivity being significantly different from background values (Arimoro et al., 2007). Such alteration in the physio-chemical properties of the water was also reported to cause alterations in the distribution and abundance of fish species in the water. Similarly, (Nwankwo, 1998) reported that wood waste affect diatom population in Lagos. Naturally, wood sawdust degrades slowly releasing methane and CO_2 into the atmosphere, thus contributing to climate change. Most times due to a system failure or a complete absence of genuine and efficient waste management, varieties of unpleasant situations become prevalent, and may include flooding as a result of drains and waterways being blocked during the raining season. They can also constitute impediments for wood workers due to unprecedented accumulation of wastes over a period of time, affecting work rate negatively and ultimately, leading to a reduced output.

4. Economic Potential and Benefits of Sawdust

Proper management and utilization of sawdust has several economic benefits and advantages. These benefits are as follows:

- Prevents environmental pollution
- Produce useful energy
- Generate income and employment

4.1 Prevents Environmental Pollution

The huge volume of sawdust generated by sawmills and other wood industries in and around Nigerian cities and towns poses environmental and health challenges. However, sawdust can be utilized directly as fuel by public and private power facilities in dedicated power systems. Utilizing sawdust as an energy source (fuel) converts environmentally detrimental materials such as residues from agricultural lands, forests and wood processing industries into fuel materials. Considering emerging global trends, the current desire for mitigating climatic changes, and the push to empower consumers in both developing and developed worlds magnify the need for a less-centralized generation, transmission and distribution of energy.

4.2 Produce useful Energy

Forest residues can be used to generate heat, electricity, liquid fuels and solid fuels. The waste generated could be used to form fuel briquettes or pellets for cooking and other heating purposes, especially at this time and age where the cost of cooking fuel (i.e. kerosene) is scares with the price of its availability, sky rocketing each day and affecting the low income earners in Nigeria.

4.3 Generate Income and Employment

The waste generated from sawdust has a lot of economic benefits. According to Oluoti et al. (2014) studies and projections have shown that several Renewable Energy Technologies (RET) would be in a position to compete with fossil fuels by 2025 if properly developed. This waste could generate income and employment for young graduates. Small and medium scale factories could be established for the production of sawdust pellets and briquettes. The channeling of sawdust into useful energy for cooking and other heating purpose would reduce unemployment and bring about increase in the growth of the economy. Essentially, the introduction of briquettes or pellets made from sawdust for energy purposes would bring about diversification and increase in the renewable share of the nation's energy mix.

5. Conclusion

In conclusion, sawdust has the potentials to grow the economy of Nigeria. The ever rising cost of fossil fuels (i.e. kerosene for cooking) and the exhaustible possibilities of their sources may warrant the use of alternative fuels (sawdust) sourced from renewable sources. At present, the main conventional source of energy used all over the world is the fossil fuels which are non-renewable and hence their deposits will eventually be exhausted. Therefore, alternative energy sources must be exploited to their full potential. One major renewable alternative source for energy utilisation is the bio-energy obtained from woody biomass such as sawdust. It is therefore, incumbent on the Federal Government of Nigeria to invest in the conversion of waste generated from sawdust into useful energy thereby mitigating environmental problems and reducing the challenges of energy scarcity and outrageous prices.

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