Sawdust Briquette: A Renewable Energy for Sustainable Livelihood of Rural Dwellers in Nigeria

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ABSTRACT

Available energy applicable in Nigeria is mainly of fossil-type (coal, petroleum products and natural gas). These are costly to acquire and intermittent in supply and for most times unavailable and/or unaffordable to majority of the citizenry. Therefore, the easily affordable energy source is fuel wood the high demand of which has resulted in rapid deforestation with attendant adverse consequences as desertification, erosion and global warming. This work does not only review the various energy resources available in Nigeria and their level or limit of applicability but also proposes the use of sawdust briquette as alternative source of energy most especially for the rural dwellers in view of the attendant socio-economic benefits. The simplicity of the manufacturing process, the thermo-graphic superiority of the product over ordinary fuel wood, and contribution to environmental amelioration are also highlighted.

Keywords: *Renewable energy, fossil fuel, sawdust briquette, deforestation, desertification*

INTRODUCTION

FAO (1988) defines energy as the ability or capacity of various material substances to produce work and/or heat. Energy is fundamental to human survival and extremely vital to economic development of any nation. It is inevitable for the production of goods and services, thus playing a very vital role in the economic growth, progress, development, poverty alleviation and security. Energy supports the provision of basic needs as cooked food, comfortable living temperature, lighting, use of appliances, pipe borne water and sewage, essential healthcare (refrigeration of vaccines, emergency, intensive care), educational aids, communication (radio, television, electronic mail, internet) and transport.

The extractive and manufacturing industries, food processing and drug manufacturing industries, metal products fabricators, tool manufacturers, welders, panel beaters, electrical/electronic technicians, carpenters and joiners and other artisans all depend on long-term availability of energy (Nnaji and Uzoma, 2010). In fact, the socio economic development of a nation which involves productivity, income growth, education and health crucially depend on availability of energy from sources that are

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ISSN: 2141-2731

accessible, affordable and environmentally friendly. Conversely, a lack of access to energy contributes to poverty, deprivation and eventual economic decline.

Nigeria's Energy Situation

Nigeria has over 35 billion barrels of oil, 187 trillion cubic feet of gas, 4 billion metric tons of coal and lignite, as well as huge reserves of tar sands, hydropower and solar radiation among others according to (Bolaji-Olutunji, Awodele, Olugbire, Adeniran and Femeyide, 2013). Sambo (2010) in a tabular manner specifically listed the fossil type energy resources available in Nigeria, thus:

Crude oil	-	36.2 billion barrels
Natural Gas	-	187 trillion cubic feet
Coal and lignite	-	2.7 billion tones
Tar sands	-	31 billion barrels of oil equivalent.

Depending mainly on fossil fuel (petroleum) is not enough to meet the energy need of the country. According to Ugah (2012), the installed capacity of grid electricity is 6000 megawatt comprising 67% thermal and 33% Hydro based. He put the hydropower generation in Nigeria as at June 2010 as follows:

			Installed capacity (mw)	*Generated power (mw)*
1.	Kainji	-	760	465
2.	Jebba	-	578	482
3.	Shiroro	-	600	450
	Total		**1938**	**1.397**

The projected electricity energy demand in Nigeria by the year 2020 was 100,000 megawatt. An estimated 60-70% of the Nigerian population does not have access to electricity. Energy demand is rather dominated by fuel wood, and women and children are the most affected in the energy crisis (Bolaji-Olutunji, Awodele, Olugbire, Adeniran and Femeyide, 2013). In Nigeria today, more than 20 million households and almost all public institutions use firewood for cooking even in urban areas and this poses a serious health, economic and environmental problem. The increasing demand for fuel wood energy is aggravated by increasing cost and scarcity of kerosene and liquefied petroleum gas. The millions of cooking fires emit greenhouse gases every day which magnitude may be overwhelming if quantified (Daramola, 2012). This study is therefore preoccupied with evaluating the potency of sawdust briquette as a renewable energy for sustainable livelihood of rural dwellers in Nigeria.

Impact of fuel wood consumption on the environment

The forest resources of Nigeria have been exposed to unmitigated exploitation, together with farming activities, urbanization and high dependence on fuel wood as source of domestic energy supply. The significantly high dependence of the vast population of Nigerians on fuel wood had brought significant pressure on Nigeria forest by way of alarming rate of deforestation. Deforestation which is the process where vegetation is cut down without any simultaneous replanting for economic or social reason has negative

ISSN: 2141-2731

implications on the environment in terms of soil erosion, loss of biodiversity in the ecosystem, and increase in desertification. The negative implication of deforestation can be better understood when viewed in contrast with the incalculable benefits of the forest to man and environment, according to FAO Fact sheet (1988), thus:

- Over 1.6 billion people's livelihood depend on the forests.
- Forests are home to 300 million people around the world.
- Many farming, silvopastoral, hunter-gather and other land based livelihoods are linked with forest and forest health.
- More than 60 million people are employed by forest based industries; contributing significantly to alleviating poverty and creating forest based enterprises and services.
- Forests play a critical role in ensuring a sustainable water supply and in the transition of society towards green economies, wood energy, green infrastructure and buildings and also as carbon sinks.
- Forests contribute to the balance of oxygen, carbon dioxide and humidity in the air.
- A tree releases 8-10 times more moisture into the atmosphere than equivalent area of the ocean.
- Forest protects watersheds which supply fresh water to rivers, a critical source of water we drink and use in our daily living.
- Tropical forest provides a vast array of medicinal plants used in healing and healthcare; and more than one quarter of modern medicine originates from tropical forest plants.
- Forest curbs transmission of infectious diseases and has a moderating effect on insect and animal-borne diseases.

Since the country is blessed with abundant alternative/renewable energy resources as hydroelectricity, solar, wind, tidal biomass there is need to also harness these resources and chart a new energy future for the country.

Renewable energy potential in Nigeria

As earlier pointed out, almost all major energy promoted/consumed in Nigeria comes from non-renewable energy sources, namely coal, natural gas and oil. Renewable resources include solar, wind, biomass (wood fuel, willow coppice, waste and agricultural products and residues such as straw), hydropower (Waves, under-water current and flowing water from higher ground and bio fuels (ethanol and biodiesel) (Vanguard, 2012). In the year 2013, the Federal Executive Council (FEC) approved the National Energy policy in Nigeria which articulated for usage of viable energy sources for national development and sustainability. The energy policy states that the nation shall continue to engage extensively in the development of electric power with the goal of making reliable electricity available to 75 percent of the population by the year 2020 as well as to ream the energy mix for generating electricity (Vanguard, 2012). Following the energy policy, a renewable energy master plan was formulated in

ISSN: 2141-2731

2006 with an understanding for achieving sustainable development and a gradual move from a monolithic fossil fuel economy to one driven by an increasing share in renewable energy in the national energy mix. The master plan also stresses the need for exploiting renewable energy in quantities and prices that will promote the achievement of equitable and sustainable growth. Many researchers had looked into the availability of renewable energy resource in Nigeria with a view to establishing their viability. Such energy resources include solar energy, wind, feedstock substrate for biogas, water lettuce, water hyacinth, dung, cassava leaves, urban refuse, solid waste, agricultural residues and savage (Bolaji-Olutunji, Awodele, Olugbire, Adeniran and Femeyide, 2013). The major energy consuming activities in Nigerian's households are cooking, lighting and use of electrical appliances. The predominant energy resources for cooking in Nigeria are fuel wood, charcoal, kerosene, cooking gas and electricity (Famuyide, *et al*, 2011 cited by Bolaji-Olutunji, Awodele, Olugbire, Adeniran and Femeyide, 2013). Other less common sources are sawdust, agricultural crop residues of corn stalks, cassava sticks and cow dung. The present energy policy is urban centred as cases of rural and sub-rural energy demand and supply do not reach the centre stage of the country's energy development policy.

Income level influences households' energy preferences and options. The choice of the type of domestic energy by households is determined by the affordability and the willingness of the consumers to pay at the prevailing rate. Currently, there is an energy imbalance within the country's socio economic and political landscapes. The decreasing availability of fuel wood coupled with the ever rising prices of kerosene and cooking gas in Nigeria draw attention to the need to consider alternative sources of energy for domestic and cottage-level industrial use. Such energy sources should be renewable and should be accessible to the poor. An energy source that meets such sustainability requirement is fuel briquette. Fuel briquette is a product of compressed sawdust, charcoal dust or other agricultural residues together with or without a binder.

Sawdust Briquette

Accumulation of sawdust and other processed wood waste constitute an environmental nuisance and traffic impediment in a wood processing mill if not removed constantly. Some producers sell them but often they are discarded as rubbish and in most instances indiscriminately burnt. Accumulated sawdust constitutes a reservoir and focus for propagation of fungi which promote wood rot. Sawdust is also a fire-risk. Other negative effects of accumulated sawdust highlighted by Godoy, Aguirre and Diaz (2001) include:

i. Release of carbon dioxide into the atmosphere as it decomposes.
ii. Emission of polluting gases when sun and high temperature provoke pyrolysis in large piles of sawdust. This combustion also increases the temperature in the area causing a hothouse effect.

A research study, by Akpan and Olufemi (2005), shows that there was no industry that utilized wood waste as sawdust generated in Akwa Ibom State either for generation

ISSN: 2141-2731

of power or for processing into value-added products. Rather, the shavings and sawdust from the carpentry shops are used directly as domestic fuels in homes for cooking and roasting of slaughtered animals and also by poultry farmers on the floor to provide warmth to the birds and as carrier for the droppings. Briquetting sawdust into more environmentally friendly fuel form is a worthwhile venture more so when a simple briquetting process is adopted.

Simple Sawdust Briquetting Process

Fuel briquettes can be made from readily available waste material as sawdust and shredded paper in urban areas. They can also be made from leaves, grasses, rice and coffee husks, maize stalks and other agricultural waste in many combinations. Sawdust briquetting process involves thorough mixing of well ground sawdust with binder (for example, starch, clay or animal dung) and a little quantity of water. Thereafter the mix is felted into a wooden frame or cylindrical metal mould and compacted together. A recipe of 5 part sawdust, 3 parts shredded paper and 1 part charcoal fines had been successfully used (Gladstone, 2014). Green raw materials like leaves and grasses are usually moistened and partially decomposed for several days, then dried and pounded or chopped into small pieces about the size of corn flakes. The raw materials are then soaked, mixed into slurry and pressed into cake in a press. Concrete mould-type press can be used but with holes to facilitate drainage of moisture. PVC pipe with holes can also be used as mould. Research findings (Aina, Adetogun and Iyiola, 2009, Ogbonnaya, 2006) have shown that briquettes have higher heat value than solid wood, that is to say briquettes generate more energy per gram compared to the same amount of solid wood. Briquettes are cleaner and more comfortable to handle and transport than charcoal and solid fuel wood.

CONCLUSION

It had been pointed out that the future economic growth of a country depends on the long-term availability of energy from sources that are accessible, affordable and environmentally friendly. Conversely lack of access to energy contributes to poverty and deprivation and eventual economic decline. Nigeria's energy development plan for long had tilted towards fossil-fuel and hydroelectricity which are not accessible and affordable by the vast majority of the rural poor. The almost exclusive dependence of the latter on fuel wood for domestic energy had contributed to alarming rate of deforestation with attendant adverse economic and environmental consequences. Rural energy option of utilizing sawdust briquette would not only check deforestation and the accompanying negative implications by taking waste out of the city but also provide less expensive, cleaner and safer cooking fuel. Briquetting would also upgrade the socio-economic status of the rural people by providing them means of livelihood, thereby contributing to sustainable development.

ISSN: 2141-2731

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ISSN: 2141-2731