

Analysis of Biomass Waste Potentials for Electrical Energy Generation in Wabane Sub Division - Cameroon

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Abstract

In order to attain economic growth and development, all the world's economies had placed greater emphasis on renewable energy development and production. This had led to the advancement of technologies to invent conversion machineries that could transform biomass residues into electrical energy. Cameroon is a typical West African country that produces large quantity of biomass residues that could be effectively utilized for the production of electrical energy.

The goal of this paper is to contribute to a sound energy market that would provide sufficient, viable and efficient energy services for the economic development of Wabane, a forest adjacent community to the newly created Tofala Hill Wildlife Sanctuary and other neighboring villages/towns through the formulation of a comprehensive program that would identify the optimal path for the development, exploitation and proficient management of biomass-energy (palm kernel waste, cocoa waste, saw dust waste, sugar cane waste etc.) resources available in this area and the needed technological means to convert them into electrical energy.

Among the various sources of Biomass residues, this paper is specifically focused on five main agricultural wastes due to the nature of biomass diversities and also because it's relative abundance in this area. These sources include; sawdust, palm-kernel, cocoa pods, coconut shell, and sugarcane waste. The major raw material is palm Kernel wastes as ERuDeF a local NGO operating in this area run four semi industrial palm oil mills amongst other private small scale mills in the area. Data on availability of these waste materials was collected by conducting many comprehensive interviews with the farmers, wood workers and other whose fields are within the study criteria.

Keywords: Analysis of biomass; Waste potential; Energy generation and electricity

Introduction

Background

Ever since the earliest inhabitants on earth, biomass in the form of burned wood in campfires for heat has been the main source of energy for meeting human needs. Today, Biomass is one of the well-known renewable energy sources for many people and industries. Using biomass for energy can have many benefits, some of which includes cutting back on waste accumulation and support for agricultural products grown round the world. Unlike other sources of energy, biomass fuels have lots of benefits both to humans needs and also to the environment, even as will be explained later [1-4].

By general definition, biomass is the organic matter in trees, agricultural crops, living organisms, humans, animals, plant materials and organic compounds used to produce heat or to generate electricity. In a simpler term biomass is plant materials and animal waste used as fuel or to generate energy [5-8].

Modern day scientific discoveries and technologies varies from simple forms of energy like coal to complex systems like electricity, ethanol, geothermal, hydropower, municipal solid waste, natural gas, nuclear, petroleum oil, photovoltaic, solar thermal, wind, to mention

just a few. According to the economists and energy developers, there is a direct relationship between energy use, economic growth and standard of living [9-11].

Thus the cry of many has been to shift from their present lack of energy to a less expensive source. Discussions on how to achieve this has been a hot topic for consideration both by energy users and energy developing scientist. Thanks to modern scientific improvement and technological advancement, the solution is right here with us in what is term as the renewable source of energy. There are various sources of biomass that could be used for the production of electrical energy. These may include sources like forest wood, crops wastes, cocoa and coconut chaffs, municipal manures, some garbage, etc. [12,13].

Aim of the paper

The goal of this paper is to contribute to a sound energy market for domestic use and for investors and to provide sufficient, viable and efficient energy services for the economic development of Wabane. This is to be achieved through the formulation of a comprehensive program that would identify the optimal path for the development, exploitation and proficient management of biomass-energy resources available to the country and the needed technological means to convert them into electrical energy.

My main targets for the supply of the biomass renewable energy will depend on the quantity of resource and the region of supply. The

following are my potential customers companies, industries, woodworks, mining sites, manufacturers, communities, individual, regions and or the country as a whole should there be enough material supply. Calculations and conversions of the material sources into electrical energy supply in kilowatts per hour will help determine the quantity in supply and the potential beneficiaries.

The Main goal of the paper is centered on the subject: Analysis of Biomass waste potential for electrical energy generation in Wabane [14,15].

Proper management and effective use of these wastes can benefit the whole country while else improper management or use can have a hazardous effect on the inhabitant.

Research questions of the paper

At the end of this research work, answers to the below questions should be obtained.

Q1. What are the potential sources of Biomass in Wabane?

Q2. How much residues/electricity could be obtained from each / total of all 11 villages?

Q3. What are the potential Biomass Technologies available for Wabane?

Q4. How to convert biomass materials into electrical energy?

The above questions give a pretty fair idea concerning the objective of the research work.

Target and limitation of the paper

Though there are numerous biomass sources mainly categorised into four main groups; agricultural wastes, forest wastes, urban wastes and animal wastes, due to the broadness on the subject and the diverse nature of it, I will like to focus mainly on the agricultural residues. And under the various sources of agricultural wastes/residues, this research work will be limited to the following five sources; coconut-husk, cocoa pods, palm kennel, sawdust and sugarcane wastes, due to the following reasons:

- That the above mentioned are relatively abundant in Wabane.
- The availability of Technology to support those sources in Wabane.
- Challenges and difficulties that might be imposed in researching on all the other sources at present. The reason the research was limited only to Wabane was also due to the below reason:
- The present energy crises of Wabane.

Theoretical Frame Work

Types of biomass residues

There are many types of biomass all categorized into four main groups even as briefly touched on above. Our focus is on; Agricultural wastes, forest wastes and animal wastes. These main groups could be regrouped into six different areas on a brother basis even as illustrated in Figure 1 below.



Figure 1: Sources of Biomass, Chaffs from palm nuts after milling, a potential raw material from bio fuel.

Agricultural wastes: Agricultural wastes are in wide ranges and varieties and the most appropriate energy conversion technologies and handling protocols also varies from one type to another. The most significant division in agricultural wastes is between those residues that are predominantly dry and those that are wet.

Dry residues: These are usually those types of crops cultivated not to be used for the primary purpose of producing food, feed or fibre, etc. like straw, corn Stover, poultry litter etc. Such residues are mostly intended for direct use as for production of energy or other similar uses.

Wet residues: These include those residues or wastes that have high water content as collected. This makes them energetically inefficient to use for combustion or gasification and are generally financially and energetically costly to transport. It is therefore preferable to process them close to production, and to use processes that can make use of biomass in an aqueous environment. Typical wet residues may include: Grass silage, animal slurry and farmyard manure.

Many agricultural crops and processes yield residues could be used for energy applications in a number of ways. Sources include:

- Arable crop residues such as straw or husks
- Animal manures and slurries
- Animal bedding such as poultry litters

Forest wastes: Forest wastes or residues are the portions of the trees that remain on the forest floor or on the landing as a result of slashing or after logging operations have taken place. Forest wastes consists mostly of tree branches, tops of trunks, stumps, branches, leaves, foliage and damaged trees that are not merchandise, wood and bark residues accumulated during wood manufacturing in industries etc.

Animal waste: The potential biomass from animal waste includes primarily waste from intensive livestock operations, from poultry farms, pig farms, cattle farms and slaughterhouses. Animal wastes are another form of biomass that is being well known for energy generation.

The development of the country's renewable energy sources has been seen as a credible option that has the potential of relieving the energy needs of the poor and securing the country's energy supply. Over the years, solar energy has been used for electricity production, crop drying and water heating.

An example is a survey of villages fitted with stand-alone solar home systems for lighting, radio and television, round the year 2015 and 2016 [16,17]. The outcome of that survey compared with the period before the solar projects was initiated shows that;

- Only about 1 percent of the adults could now watch television and listen to radio or play cassette.
- Television acquisition of solar home systems (SHS) has increased threefold. Commercial activities in the evening have increased by 3-5 percent.
- Emergency health cases like child delivery could not be well attended to at night due to no lighting system.

Advantages and Disadvantages of Biomass Energy Development

Asking about the importance of biomass energy is as important as asking about the importance of energy itself. This is because bio energy is no difference from any form of energy since it could be used to produce energy of any kind; being electrical, dry cell, liquefied fuel etc. The importance of energy could be seen from the very time we wake up from our beds to the time we go to sleep at night.

What of our mobile phones, computers, watches, cars, home lights etc.; all these are empowered by energy. Without energy we could hardly be comfortable living an enjoyable and easier life. Life might be simple without energy but difficult to do without it. Let's now see some importance in developing such energy.

Income Generation

Those days were gone where waste was termed "useless". In today's world waste is termed "money". How? To help us understand let's take an example from the Energy Information Administration in US. According to the EIA estimation of biomass resources shown, there is over 590 million wet tons of biomass available in the United States alone on an annual basis; 20 million wet tons (enough to supply about 3 gig watts of capacity) are available today at prices of \$1.25 per million Btu or less. That means it's possible to generate an approximate amount

of \$735.5 million from biomass in US alone even as a minute fraction of the total supply of energy availability.

Developments

A sustainable energy supply, both in the short-and the long-term, is needed for promoting good economic growth and infrastructural development which will in turn promote high and quality living conditions of people, as well as a lucrative, protective and illuminative environment.

Low cost, savings and improved living standard

Undoubtedly biomass is known to be relatively less expensive compared to any other form of electrical energy. This therefore shows that, introduction of bio energy in Wabane will be highly patronized by the most. This will include both those who could not afford electrical energy previously and also those might already be using other alternative sources due to its relatively low cost (biomass-electricity). Low cost on energy usage will mean less money doled out, thus this will promote more savings. And more savings will lead to lead to improved living standard since the unused money will be used in catering for other needs like hospital expenses (good health), school fees (quality education and skilled labour), balanced and nutritious food (strong and healthy), better homes, good and advanced electronic gadgets (computers etc.) and the list goes on and on [18].

Despite the various sources of biomass wastes, the research work will be limit on the major sources of bio-wastes in Wabane. The research is limited to the agricultural field and the sources of my research are as follows:

- Cocoa Pod
- Palm-Kernel/Husks
- Wood Wastes / Sawdusts
- Coconut Wastes
- Sugarcane Wastes

Conclusion

This paper presents the status of research of biomass potentials for the production of electrical energy in Wabane. Biomass potentials can be generated from different sources. These may include residues from agricultural produce; forest plants wastes, rural or animal wastes.

Among other things we also realize the economic importance of biomass. Biomass is one of the cheapest forms of renewable energy today. It also has many environmental and ecological benefits and offers numerous economic security and energy benefits. As an example, biomass already supports 66,000 jobs in the United States alone. Other objective planed by the AOE shows that the realization of its plane could support the biomass industry and create as much jobs as three times what exist presently in the US.

Since the development of every economy depends much on the availability of energy, the availability of biomass energy for such developing areas like Wabane will boost up its economic development at a higher rate. The production will also help in resolve the present energy crises thus boosting up production.

We have seen the numerous benefits that come with biomass. These advantages may also include lower cost on energy consumption for

especially biomass waste producers like woodworker and farmers. It is also reliable and controllable [19,20].

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