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ASSESSMENT OF BIOMASS BRIQUETTE USE AS ALTERNATIVE SOURCE OF RENEWABLE ENERGY IN KAMPALA DISTRICT

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ABSTRACT: *The use of biomass briquettes as an alternative source of renewable energy is a recent development in an effort to address growing energy demand in developing countries in general and Uganda in particular. The study aims to assess local perceptions regarding briquettes use and the effectiveness of briquettes as an alternative source of fuel in Kampala district. We collected data from companies and institutions on selected socio-economic factors that promoted the popularity and use of briquettes. Data was analyzed for mean frequencies, chi-square tests and cross tabulations. Results show that briquettes use was growing in popularity. However, its local use had weak association with level of education (r =0.403) but statistically significant at P<0.05. This level of significance showed that education was important in explaining the likelihood of consuming briquettes as a clean source of energy. The study concluded that Briquettes have a great potential to be used to replace or supplement the current energy sources being used for household energy especially for cooking. It was recommended that Briquettes form a viable source of alternative energy for companies and institutions. The Country lies among the high agricultural potential areas with high population densities and as a result, there is reduced land acreage to plant trees for wood fuel production.*

KEYWORDS: Biomass Briquette, Renewable Energy, Wood Fuel Production, Energy Demand, Kampala District, Uganda

INTRODUCTION

The Ministry of Energy and Mineral Development warns that wood fuel requirements have contributed to the degradation of forests as wood reserves are depleted at a faster rate in many regions while charcoal stoves, ovens and kilns used in Uganda are inefficient. (MEME,2012). Several initiatives to conserve biomass have been undertaken by the government and the private sector and the government has started to realize a significant impact noting that some pilot projects to produce biomass energy from animal and human wastes or gas plus thermo electricity also offer good opportunities. Statistics show that there are about 500 functioning biomass plants in the country at present and over 250,000 zero grazing farming households and these define the extent of the potential for small household biomass users in the country. According to MEMD, (2012), biomass is a non-poisonous and non-toxic material which when mixed with air, it burns with a blue flame and has no soot or any offensive smoke.

Biomass usage and production has been in existence for decades and has been the major source of power for Ugandans (MEMD, 2012). According to UBOS, Biomass is used by over 90% of the population in Uganda. It was further noted that a vast majority in both middle- and low-income earning classes have opted to use biomass because it is the cheapest form of energy for most families. However, whereas wood has always served as a source of fuel for fires and ovens and conventional heating methods, biomass energy advancements are a few steps beyond that. Currently, these biomass fuel products are harvested and produced in larger quantities and used in supply of heat in institutions and companies for cooking and drying materials such as sawdust for making briquettes.

Okoko et al (2017), reveal that Biomass energy can be produced in an environmentally friendly way if raw materials and production technologies are adequately selected, and biomass energy supply chains can be sustainable if carbon emissions and economic efficiency are properly addressed. A systematic review conducted by Robledo-Abad et al (2016) indicates that knowledge about the impacts of bioenergy production on sustainable development is primarily concentrated in developed countries. They recommend increasing such knowledge in developing countries. At the same time, assessing the sustainability of biomass energy supply chains is often complicated by data scarcity. Many developing countries lack up-to-date information that can be used in decision-making. For example, up-to-date forest inventories, needed for sustainable wood fuel production, are often unavailable.

In many parts of the world, people are making this new and modern fuel, saving time, energy, and environment and creating more income. Fuel briquettes are unique because they provide a fuel wood alternative from resources that are right under your feet or in your waste bucket. Fuel briquettes can be made relatively quickly at a low cost to the manufacturer or consumer and can be adapted and applied in a wide variety of settings, making the briquettes appropriate and sustainable to consumers.

For a longtime, carbon emission has been at higher rate leading to climate change and global warming and environmentalist have been emphasizing use of biomass briquettes technology to reduce the emission of carbon dioxide. However, majority of the people do not use biomass briquettes, they rather use firewood or wood fuel and charcoal. It's likely that even those who use briquettes as source of fuel do not use them frequently- the effort to use biomass briquettes as recommended by (USDA, 2013) report remained low.

There are many companies manufacturing briquettes in Uganda but few people use briquettes as a source of fuel. It was against this background that this project was conducted so as to assess the factors affecting effectiveness of biomass briquettes technology as an alternative source of fuel in Kampala district.

The Energy sector is experiencing challenges and much should be done to make it grow as it is the significant contributor of clean environment. Charcoal produces very high volumes of carbon dioxide which is one of the gases that is harmful to the environment. There is need for intensive research and development in the briquettes industry and also lobbying of government institutions to provide a framework that would be fundamental to promote the growth of the sector. (Briquettes sector Kenya, 2013).

METHODOLOGY

The study was carried out in Kampala district and was focused on obtaining information from selected companies and institutions. This study used interviews and questionnaires to collect data. Respondents from selected institutions and companies were selected using purposive sampling and simple random sampling to enable the process of data collection. The study constituted a sample of thirty-six respondents from four institutions and two companies. The respondents from the different institutions included the administrators and cooks who constituted the population of this study. These were considered because they have reliable information on the topic of the study and also basing on the fact that researcher is familiar with the study area will make it easy for him to relate and interact with respondents.

The researcher used both qualitative and quantitative approaches of data analysis; qualitative analysis was consisting of opinions, ideas and statements so as to generate conclusions about the effects of biomass briquettes technology as an alternative source of fuel. Quantitative analysis was focused on using frequency, percentage and presentation of findings in tables, graphs and figures to represent the views of people about the study. These approaches were helpful to provide details of view of findings. The researcher used GSPSS to present and analyze data.

RESULTS AND DISCUSSION

The results show that a good number of respondents (44%) had attained graduate level of education, and most of these were categories of professional serving as administrators in their respective institutions. For example, up to 12 (35%) were bachelor degree holders, 10 (29%) were certificate holders, 9 (27%) were diploma holders and only 3 (09%) were post graduate holders. The list percentage 9% was holding key administrative roles in their respective institutions and companies.

The results presented in **Table 1** below show that majority of the respondents (55%) obtained information regarding briquettes from their friends and relatives, who were already users or had prior knowledge. Most of briquettes producers started less than 3 years ago, which suggests that briquettes production is a recent innovation in Uganda and, or beginning to gain popularity among local users and institutions. This is consistent with the observations made by Robledo-Abad et al (2016) who explained that for several years' knowledge on sustainable biomass energy production was concentrated in developed countries, and only a recent venture in developing countries like Uganda. Our findings also show that organizations are beginning to consider briquettes use seriously as an alternative to other unclean sources of energy. Apart from charcoal which is still a leading energy sources in Kampala, briquettes ranked second followed by electricity and firewood. From the findings, as many as 74% of the respondents were excited about briquettes use and were more than willing to recommend its use to their friends and relatives. The respondents cited a lot of benefits including being able to save money on fuel use.

Table 1: A summary of Responses Obtained for Various Factors Considered During the Study

Parameters	Frequency	Percentage (%)
Knowledge of briquettes - x2 = 94.01, df= 30, p = 0.001		
Friends	12	35
School	5	15
Producers	5	15
Course unit	5	15
Neighbors	7	20
Difficulties in obtaining briquettes - x2 = 16.19, df= 6, p = 0.013		
Yes	12	35
No	22	65
Start of briquettes use - x2 = 44.17, df= 12, p = 0.001		
Less than 3yrs	18	53
3 - 5yrs	9	26
5yrs and above	7	21
Source of energy - x2 = 65.5, df= 18, p = 0.281		
Electricity	6	18
Charcoal	13	38
Firewood	5	15
Briquettes	10	29
Willingness to recommend briquette use - x2 = 29.89, df= 6, p = 0.001		
Yes	25	74
No	9	26
Reasons for using briquettes - x2 = 56.9, df= 24, p = 0.002		
Save from energy sector	9	26
Affordable energy	6	18
Provide clean environment	3	9
Friendly use	8	24
Reduce cost	8	24
Does briquettes use allow savings? - x2 = 22.43, df= 6, p = 0.001		
Yes	23	68
No	11	32
Your observations on briquettes use - x2 = 57.31, df= 18, p = 0.001		
Easy to use	11	32
No smoke	8	24
No ash, very little if at all	9	26
Cheap	6	18

Briquettes technology used in companies and institutions is being influenced by a number of factors ranging from socio-economic to non-economic factors. These factors influence fuel choice and substitution. The implications of fuel choice are on the user's health and reduced poverty, increased productivity as well as general sustainability. The study identified the following factors to have a strong influence on the choice of briquettes as an alternative fuel among those institutions and companies.

Table 2: Relationship between use of briquettes and each parameter

Dependent variable	Parameters	Pearson 'r'	P-value
Use of briquette			
	Level of education	0.403	0.018
	Start use of briquette	0.645	0.001
	Produce own	0.658	0.001
	Source of briquette	0.438	0.001

The relationship of briquettes uses and level of education was weak (r =0.403) but statistically significant at P<0.05. This level of significance showed that education was important in explaining the likelihood of consuming briquettes as a clean source of energy. From the table, it is also clear the relationship between use of briquettes and the start use of briquettes was statistically significant and moderately high (P < 0.05, r=0.648), suggesting that those who started earlier have realized the benefits and were likely to continue using briquettes as new consumers enter the market. In contrast with other variables such as education level, the relationship of briquette uses and production was strong at (r =0.658) and very significant (p-0.001), further demonstrating that local production was motivated first by the need for own use followed by the need to generate income through sales. Finally, the results also show that source of briquette did not matter so much to the users. Moreover, the relationship between source of briquette and use of briquette was week at (r=0.438) however there is also showed that source of briquette was important as reflected in the significant level.

Table 3: Organizational Percentage Ranking of Briquettes Use

Variable	Makerere University	Mulago Hosp.	Kampala Jullitone	Kabojja SS	Sasseco Food Processing	Kansanga Pri.	Gombe SS
Energy Saving	42.85	42.85	14.29	0.00	0.00	0.00	0.00
Energy Efficiency	0.00	0.00	42.85	57.14	0.00	0.00	0.00
Cheapest Source of Energy	0.00	0.00	0.00	12.50	62.50	25.02	0.00
Future Source of Energy	0.00	0.00	0.00	0.00	0.00	40.02	60.00
Best Tech. for Providing Energy	50.02	0.00	0.00	0.00	0.00	0.00	50.02
People Didn't Know About it	33.31	0.00	0.00	33.31	0.00	33.31	0.00

Energy saving is the essential factor in energy transforming energy sector. The table showed that Makerere university and Mulago hospital had the highest percentage in ranking briquette as an important product in terms of energy saving. This perception had the significant influence in the level of using briquette as the source of energy. Also, Kabojja secondary school had the highest percentage (57.14) which showed that energy efficiency was one of the greatest factors which influence the use of briquettes in institutions and companies while Sessaco food processing ltd had the percentage of 62.50% which showed that briquette play a vital in providing energy with little amount that influence the level of use. However, the DLSU Research Congress (2017) revealed that everyone was thinking about how to make their homes greener and how to save energy. Everyone was aware of the problems presented by global warming and we were all thinking of ways to change our lifestyles in order to help stop this phenomenon and keep our world safe. This is why biomass briquettes are important. The main source of energy for most areas of the world is fossil fuels, which usually makes use of coal in order to power boilers to make steam for energy. Briquettes made from biomass are a great substitute for coal, since they are made of natural materials and do not add to the pollution in the world. Because of the production of briquettes, many companies use biomass briquettes since they found out its benefit and how it could lower their carbon footprints while being affordable. These briquettes were cheaper than coal in the long run, and could be used for a long time.

Coal is one of the most dangerous ways to produce energy nowadays because of its pollution to our environment. This is why it is necessary for us to limit our use of charcoal and find another way to get energy. Biomass is a great way to go since it is easy to get and use. The briquettes are made from plants and natural waste from animals.

CONCLUSION

Biomass briquettes have a great potential for providing cleaner source of energy to the rural poor in Uganda and other countries on the African continent. Our results show that a few institutions in Uganda have already adopted briquettes use as alternative energy source. From the experience of briquette users, it was evident that briquettes are safe sources of fuel in terms of low pollution as it produces less smoke, if any. Majority of the respondents recommended its use as supplement to the current energy sources relied upon by most households for cooking. Biomass technology relies on biomass waste as raw material and hence does not contribute to deforestation like charcoal does. Uganda could promote briquettes use in rural settings and peri-urban areas in order to facilitate transition to green energy sources with low costs to the consumers

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Conflict of Interest

The authors declare that they do not have any conflict of interest.

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