ISSN: 0975-833X

Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 9, Issue, 08, pp.56864-56866, August, 2017

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

RESEARCH ARTICLE

UNPRECEDENTED TRENDS IN RENEWABLE ENERGY: A COMPARATIVE ANALYSIS OF ECONOMIC & ENVIRONMENTAL ASPECTS OF BIOMASS BRIQUETTES VIS-À-VIS FIREWOOD / ROOT STOCK AS BOILER FUELS

***Prof. Niharika Mishra**

Assistant Professor, Ramaiah Institute of Management, Bangalore, India

ARTICLE INFO

Article History:
Received 12th May, 2017
Received in revised form
04th June, 2017
Accepted 23rd July, 2017
Published online 31st August, 2017

Key words:

Wood biomass,
Renewable energy,
Biomass Briquettes,
Root Stock,
Boiler Fuels.

ABSTRACT

Wood biomass is an important item in development strategies of developed and environmentally aware societies as a renewable and environmentally friendly source of energy. However the knowledge and expertise of the essential parameters regarding this source is scarce. In nature, all biomass eventually decomposes to its elementary molecules with the release of heat. Therefore, the release of energy from the conversion of biomass into useful energy imitates natural processes (but at a faster rate), and this energy is a form of renewable energy. Converting biomass to fuel can be as simple as cutting trees into small pieces so they can be burned to produce heat or electricity, or as complicated as converting it into a liquid or gaseous fuel. Firewood is a local and renewable energy source. Its carbon balance is neutral; therefore it does not increase greenhouse effect and its local character adds to the sustainability issue. These facts make it a good option for heating. However, firewood market has not been deeply analyzed in relation to a renewable energy market and energy market in general partly also because of the lack of data. In general, there is not much information about this sector available. Furthermore, the grey market of firewood makes a study on it even more difficult, consumption in rural areas, which is the most important one, is very difficult to assess. This study throws light on the comparative analysis of economic and environmental aspects of biomass briquettes vis-à-vis firewood/root stock as boiler fuels.

Citation: Prof. Niharika Mishra, 2017. "Unprecedented trends in renewable energy: a comparative analysis of economic & environmental aspects of biomass briquettes vis-à-vis firewood / root stock as boiler fuels", *International Journal of Current Research*, 9, (08), 56864-56866.

INTRODUCTION

Solid liquid and gaseous fuels are available for firing in boilers, furnaces, and other combustion equipments. The selection of right type of fuel depends on factors such as availability, handling, storage, pollution and landed cost of fuel. Understanding of the key features of fuel helps in selecting the right fuel for the required application. Taking into account the cost and heat value, most large size Boilers generally use either Coal or Biomass or a mix as specified by OEMs. On the other hand, small and mid-size boilers have more flexiblity in terms of fuel type and size. These boilers use diverse fuels based on cost, heating value and other environmental considerations varying from case to case. In Indian context, the selection of fuel for small and mid size boilers depends mainly on local availability and landed cost while environmental considerations and fuel efficiency play a insignificant role in decision making. Generally in South India and specially in and around Bangalore, use of Firewood (Junglewood) and Root Stocks of Eucalyptus, split to required size, are more prevelant fuels for small and mid size Industrial Boilers. Besides these fuels, Industries also procure a small quantity of Biomass Briquettes from local manufacturers to supplement their fuel requirements. Therefore, in order to compare the cost-benefits of using Firewood / Root Stock and Biomass Briquettes, it is prudent to first understand various attributes that play decisive role in a fuel.

Corresponding autor:* **Prof. Niharika Mishra,
Assistant Professor, Ramaiah Institute of Management, Bangalore, India.

Determinants of Heating Value of Fuel

Proximate Analysis of Solid Fuels infers following constituents by weight:

Combustibles (C)= % of Fixed Carbon + Volatile Matter
Ash (A)= % of Natural + External Silica present in Matter
Moisture (M)= % of Water contained within the pores of matter

Such that; C + A + M= 100% of Fuel Weight

Since it is the Combustible content which produces energy, the Heat Value of a Solid Fuel is directly proportional to the quantum of Combustibles (higher combustibles, higher the heat value) and inversly proportional to Ash & Moisture (higher Ash / Mositure, lower the heat value) per unit weight in a given volume.

A Comparison of Characteristics of Firewood, Rootstock & Biomass Briquettes

Table 1. Sourcing & transportation

FEATURES	FIREWOOD	ROOT STOCK	BIOMAS BRIQUETTES
Origin	Grown on Private lands, Roadside & Govt. Lands	Grown on Private lands, Roadside & Govt. Lands	Manufactured
Availability & Seasonality	Seasonal Availability based on Socio-Economic & Climatic conditions	Seasonal Availability based on Socio-Economic & Climatic conditions	Available consistently almost 9 months in a year
Quality Consistency	Highly Variable	Highly Variable	Variable season to season
Modus Operandi of Supply	Petty contractors harvest and transport wood from source to Buyer.	Petty contractors uproot, split and transport roots from source to Buyer.	Manufactured & Delivered
Statutory Transit Requirements	Firewood cutting & transit is strictly regulated through Forest Permit requirements. Supplier is responsible for arranging valid transit permits before transportation.	Roots extraction & transit is not regulated through Forest Permit requirements.	Not Applicable
PHYSICAL FEATURES			
FEATURES	FIREWOOD	ROOT STOCK	BIOMAS BRIQUETTES
Size & Dimensions	Non uniform; Often needs resizing. Logs of varying lengths & dia. Often needs resizing and further splitting.	Non-Uniform; Variable sizes in each lot. Roots split into two or three pieces. Highly non uniform with sharp edges and split ends. Needs resizing mostly.	Multiple Shapes and Sizes. Mostly Cylindrical Briquettes with Dia ranging from 60mm to 90mm and varying lengths.
Packing	Unpacked & Loose	Unpacked & Loose	Packed in HDPE Bags
Handling	Multiple persons required; More when resizing & splitting is done	Multiple persons required; More when resizing & splitting is done	One person is adequate for feeding
Storage	Needs large area. Difficult to maintain neatly. Can not be stacked properly.	Needs large area. Difficult to maintain neatly. Can not be stacked properly.	Easy due to packaging
OTHER ENVIRONMENTAL IMPACT RELATED CHARACTERISTICS			
FEATURES	FIREWOOD	ROOT STOCK	BIOMAS BRIQUETTES
Emission	Carboneous. High Smoke volumes. Soots blow-up through Chimney	S, CO_2 &Ph fumes. High Smoke volumes. Soots blow-up through Chimney	Non Sulphurous Fumes. No NO_X emissions
Solid Waste	Generated 15%-20%	Generated 15%-20%	≤10%
Impact on Boiler	Frequent maintainance	Regular maintenance. More wear & tear	Non-Corrosive; Minimal clinkering & flaking

FUEL EFFICIENCY			
FEATURES	FIREWOOD	ROOT STOCK	BIOMAS BRIQUETTES
Density	450 – 700 Kg/m^3	500 – 700 Kg/m^3	800 – 900 Kg/m^3
Moisture	30% - 45% (Say Avg - 37.5%) Freshly cut tree has around 60% moisture. After conversion into logs and transportation, the moisture at the time of sale / delivery is normally around 30%-45%	40% Eucalyptus has high moisture contents and maximum water is stored in roots. When uprooted, roots have around 70% moisture. After splitting and transportation, still around 40% remains	10% - 15% (Say Avg - 12.5%) Briquettes are manufactured only with medium moisture raw material. Hence output is aroun 10%-15%.
Ash (%)	15% to 19% (Say Avg - 17%) External silica get carried over during harvesting, felling, handling and trsnaportation operations.	15% - 25% (Say Avg - 20%) A lot of additional mud / silica gets entangled during uprooting by JCB and splitting operations in field.	10% - 12% (Say Avg - 11%) Normal % of ash found in Biomass plus natural contamination in handling on bare ground.
Gross Calorific Value	2500 to 3000 Kcal/Kg (Say Avg - 2750 Kcal/Kg)	3000 to 3500 Kcal/Kg (Say Avg - 3250 Kcal/Kg)	3800 to 4200 Kcal/Kg (Say Avg - 4000 Kcal/Kg)

COST COMPARISONS ON GROSS & NET BASIS PER UNIT OF DIFFERENT FUELS			
FEATURES	FIREWOOD	ROOT STOCK	BIOMAS BRIQUETTES
Gross Price incl. Delivery to Buyer's place (Rs/Kg): As is Basis	3.50	3.60	5.50
Net Wt. of Combustibles after deducting Moisture & Ash contents (Kg of Combustibles/Kg of Purchased Fuel)	0.46	0.40	0.77
Net Price incl. Delivery to Buyer's place (Rs/Kg of Combustibles)	7.69	9.00	7.19
Avg. Calorific Value (Kcal/Kg)	2,750	3,250	4,000
Net Price per '000 Kcal (Rs/'000 KCal)	2.80	2.77	1.80

The Calorific Value of a fuel is a measure of Heat Generated/Unit Weight i.e., Kcal/Kg. Hence density of the fuel also becomes a vital factor.

Thus, primarily the Heat Value of Solid Fuels is a determinant of :

1. Density
2. Moisture
3. Ash

Density

Dense fuels will have more calories per cubic metre than lighter fuels, given a similar moisture content. Less dense fuels are likely to have bigger pores within the matter which will hold higher moisture and / or likely to absorb more ambient moisture. This is detrimental to good combustion. Also ligher fuels burn quickly due to higher net surface area which comes in contact with free Oxygen. Generally, for long sustaining combustion requirements, dense fuels are ideal.

Moisture

The more moisture in fuel, the slower it burns, the more smoke and pollutants it gives off and the quicker it soots up the chimney. Burnt together with other fuels, damp fuels create acids that quickly corrode any metal within boiler and chimney. Commercially, Moisture is doubly detrimental to fuel efficiency owing to following reasons:

1. Buyers pay same price for water content also which does not burn. Hence waste of money.
2. Higher the moisture, more the latent heat required to evaporate it. A good portion of combustibles are used to nullify water content in fuel. Hence a portion of usable fuel is also wasted.

Ash

Ash content in fuel originates due to –

1. Natural Silica present in biomass matter and;
2. External contamination to which the fuel has been subjected during processing / handling.

While natural Silica content is not much detrimental to fuel efficiency due to minimal presence, the external Silica (contamination) content is highly detrimental for combustion efficiency. Excess Ash contents generates additional quantity of solid wastes like tar and flyash after combustion which harm the Boiler tubes and reduce the Boiler life and efficiency in long run. Besides these wastes could be sometimes hazardous and disposal of these is a major challenge. Commercially, external Ash content / contamination is waste of money as it replaces combustibles to that extent per unit weight. It can be noted that based on Commercial Value, Environmental Impacts, Ease of Handling, Availability and Quality Consistency, Biomass Briquettes are much better Fuel for continous industrial operations. For foundries & furnace, thermal application like steam generation in boilers, any type of biomass briquette can be used for heating purposes, drying process and in gasification plant replacing conventional solid fuels like Coal and Firewood and liquid fuels like Diesel, Kerosene, Furnace Oil (FO), etc. Briquettes are going to be the most important fuel of the world. An upcoming use of briquettes is in electricity generation, the electricity generation could be cheaper than coal if biomass could be sourced economically. If companies using boilers and power plants using coal resort to briquettes the scenario will definitely change and India may become the leading country in power generation through solid biomass and a major green electricity producer.

REFERENCES

Ahlers, Christopher D. 2016. Wood Burning, Biomass, Air Pollution, and Climate Change, 46 Envtl. L. 49

https://directory.biomassmagazine.com

Shaha, A.K. 1974. *Combustion Engineering and Fuel Technology*. New Delhi: Oxford & IBH Publishing Company.

****