UTILIZATION OF BIOMASS IN BRICK KILNNING

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ABSTRACT

Bricks have been used as construction material for many millennia. They have been found at the historical sites all over the world, including valleys of the Indus and 'Ganga' rivers where ancient civilizations flourished as early as 3300 B.C. For example at 'Mohenjodaro' there is evidence to show that perfectly formed uniform bricks were fired in brick kilns and used extensively for making buildings. The structures there include houses, the 'Great Bath', granary, roads and toilets. The main raw material for making bricks is clay which can vary considerably in physical properties, color, hardness, and mineralogical content. However, the raw material must essentially have the ability to be crushed and mixed with water to form a plastic material which can be moulded into various shapes required. In addition, upon heating to a high temperature these bricks should become hard, have high compressive strength and be weather resistant. It is estimated that world-wide there are 300,000 brick kilns with a total production of 1350 billion bricks per year. Brick production is concentrated in four countries which account for about 75 percent global production—China with 54 percent; India with 11 percent; Pakistan with 8 percent; and Bangladesh with 4 percent.

Keywords: Mineralogical, Compressive Strength, Weather Resistant,Contructional Material,Brick Kilns, Civilization,Crushed etc.

I.INTRODUCTION

The output of the Indian brick industry is the second largest in the world after China. It was estimated that total production of bricks in the country is about 140 billion per year in 2000-01. The growth rate of the industry was estimated to be approximately at 9 per cent per year in 2000-01 while other growth estimates range from 5 to 10 percent per annum. A study estimated that the building construction sector in India will grow at compound annual growth rate (CAGR) of 6.6 percent per year in the period 2005-30.

By 2001, using the age-old manual moulding processes, the estimated requirement of top soil for brick manufacturing was about 350 million tonnes per year. Because of accelerating economic growth there has been a growing demand for building materials, particularly bricks in this country. It should be noted that the major concentration of brick kilns is in the rural areas in the proximity of rapidly expanding towns and cities. Urban demand for bricks is growing exponentially because of the requirement for infrastructure, commercial and residential buildings.

Fig.1: A View of a Biomass Fired Brick Kiln in Rajasthan

➔RISING DEMAND FOR COAL

In case a growth rate of 6 and 9 percent per annum is assumed, the total annual production of bricks would be around 266 and 361 billion respectively, for the year 2011-12. Furthermore, assuming a coal consumption of 17.14 tonnes per one lakh bricks, the corresponding consumption of coal would be 46 million tonnes and 61.9 million tonnes, respectively. The estimates shows a demand of 61.9 million tonnes, or even 46 million tonnes of coal for the brick kiln industry in 2012, are significantly high—especially at a time when there is a shortage of coal in India. The good news from major north Indian states is that in the last few years there has been a rapid shift from using coal to using biomass for firing bricks in the brick kiln industry.

➔COMPARATIVE COST OF COAL AND BIOMASS FIRED KILNS

Based on data received, the consumption of coal in a coal based kiln in a traditional fixed chimney-Bull's trench kiln (FCBTK) is 136.4 kgs. of coal per 1000 bricks. The cost of coal in a coal based brick kiln is estimated to be Rs. 1022 per 1000 bricks with the coal rate of Rs. 7500 per tonne at Jaipur. On the other hand biomass based fuel consumption is 254 kg/1000 bricks. The cost of biomass is approximately Rs. 765 per 1000 bricks when the average price of biomass is Rs. 3000 per tonne at Faridabad. Thus fuel cost in the biomass based kiln is about 75 percent that of coal based with a difference of Rs. 257 per thousand bricks. Therefore with a production of 75 lakh bricks per year a saving of nearly Rs. 19.3 lakhs per annum is possible. However, the coal based brick manufacturers insist that they are able to get better price for their bricks as they are able to produce more grade I bricks than those produced based on biomass kilns. Considering the firing process, the strength of coal fired bricks is relatively higher as compared to biomass fired bricks. However, since the structures of building now a days is column based, therefore the walls are no longer load bearing but partition walls—as a result biomass based bricks are gaining acceptance from builders.

II.DIFFERENT TYPES OF KILNS

Major types of technologies used for manufacture of bricks in India include clamp type, FCBTK or moving chimney BTK, natural and fixed draft zig-zag kiln, vertical shaft brick kiln (VSBK), down-draught kiln and others. However, there has been very little impact of more efficient technologies on the brick industry as the industry continues to use traditional FCBTK. It has been estimated that 70 percent of the brick production in India is from such kilns. The most popular brick kiln technology used in north India is natural draught FCBTK. The traditional straight line fi ring BTK is reported to be about 10 percent less energy efficient as compared to **zig**-zag BTK and has a higher carbon foot-print.

(A). FCBTK KILN

(C).DOWNDRAFT KILNS

(B).VSBK KILNS

(D). CLAMP KILNS

Fig .2 Different Types of Kilns (A,B,C,D)

Fig.3: Distribution of Different Type of Kilns in India

III.FUEL CONSUMPTION OF VARIOUS BRICK KILNS

➔**First comparison:** The energy consumption VSBK, at 0.7 MJ/kg of fired bricks, has been estimated to be half of that of FCBTK, which is 1.4 MJ/kg of fired bricks.

➔**Second comparison**: For moving chimney BTK the coal consumption ranges between 20 to 24 tonnes per lakh bricks, whereas for fi xed chimney it is around 16 to 20 tonnes per lakh bricks.

➔**Third Comparison:** Based on data from a well-established coal based kiln in Rajasthan it was found that the coal consumption in this kiln was 13.7 tonnes of coal per one lakh bricks compared to the consumption of fuel in a well known biomass FCBTK in Haryana where it was found that the biomass consumption was 25.4 tonnes of biomass per one lakh bricks.

Fig.4: Biomass Handling and Transportation

NORTHEN INDIA: A REVIEW

It has been estimated that there are about 25,000 brick kilns in Haryana, Punjab, Rajasthan and Uttar Pradesh which produce about 32.5 billion bricks annually. Uttar Pradesh has the largest number of brick kilns accounting for nearly 65 percent of the kilns while the other three states share an almost equal number of kilns. The percentage of biomass used by the brick kiln industry are:

- Punjab – 5 percent
- Uttar Pradesh –30 percent
- Haryana – 60 percent
- Rajasthan -- 98 percent

IV.BIOMASS USED IN BRICK INDUSTRY OF RAJASTHAN

The total number of brick kilns in Rajasthan is reported to be 3000. The average production of bricks in a kiln is about 4 million bricks per year. It is reported that 98 percent of brick kilns operate on biomass with only a few of them operating on coal. Even coal based kilns appear to be contemplating conversion to biomass, as coal prices rise rapidly. Rajasthan is one of largest producer of mustard seed with an estimated production of 2.7 million tonnes per year (45 percent of the nation's production). Therefore, mustard crop residue is abundantly available to be used in the brick kiln industry and biomass power sectors. At different times diff erent types of biomass are available to the brick kiln industry. These include mustard husk, *Julifl ora Prosopis*, groundnut shell, cotton stalks and others. Mustard crop residue is the dominant biomass used in the brick kiln industry accounting for an estimated 80 percent. Interestingly, in this State the use of straw as a biomass for industry is not permitted—as there is an acute shortage of cattle feed. One survey estimates that 1.6 million tonnes of biomass is used in Rajasthan by the brick kiln industry. As for coal use, one coal-based brick kiln surveyed used between 750 tonnes to 1,050 tonnes of coal per year depending on the production.

V.CONCLUSION

Solid bricks are most popular in the country and the process of making these is still largely manual and highly labor intensive. With the introduction of the Mahatma Gandhi National Rural Employment Act and the rapid development of the country there is an increasing shortage of labor and the costs are rising steeply making increasing mechanization inevitable in the coming years and decades. The rapidly rising coal prices will force the industry to either adopt more energy efficient kilns or to switch over to biomass based fuels. Moreover, with rising cost of inputs including soil and sand, it appears that brick making technology is on the verge of revolution which will make this industry less resource intensive, more energy efficient and result in benefits to the consumer. Hopefully, this will also contribute to the energy security of India and reduce emissions of green house gases. With the landed price of coal mounting there is a definite price advantage of biomass over coal, and the use of biomass is bound to go up. The quality of bricks being made from biomass firing is said to be inferior to bricks made from coal firing—but with the switch over to reinforced concrete construction the relevance of the superior quality of coal fired bricks is declining.

REFRENCES:

[1]Bionett (2000). Morten Grønli, Morten Fossum, Øyvind Skreiberg, Lars Sørum og Johan E. Hustad*: Norsk Bioenergi i nettverk. Sluttrapport*: http://www.energy.sintef.no/bionett/intern/sluttrapport_bionett.pdf

[2]Bringezu (2003). *Industrial Ecology and Material Flow Analysis; basic concepts, policy relevance and some case studies*. Wuppertal Institute, Germany.

[3]Burning Bagasse (2004). Information about bagasse: http://energyconcepts.tripod.com/energyconcepts/bagasse.htm

[4]Baardsen, Byhre, Jostein (2002): *Bioenergi*. Norsk treteknisk institutt. http://www.treteknisk.no/Tema/miljo/energi/Bioenergi.pdf

[5]Dellepiane, Daniela, Barbara Bosio and Elisabetta Arato (2003): *Clean energy from sugarcane waste: feasibility study of an innovative application of bagasse and barbojo*.

[6]Journal of Power Sources, Volume 122, 2003. pp. 47-56. Chardust Ltd. (2004). Information available at the company's web page: http://www.chardust.com/

[7]Apolinario (1997). Apolinario, M. A., Gatanela, D.V., Escarrila, L. T., Gaston, N. D.:*Study on production of briquettes from bagasse*. Sugar and Sugar By-products

[8]Research Division, Sugar Regulatory Administration, Bacolod City. http://www.philsutech.com.ph/convention/45/papers/fab/briquettes.pdf

[9]APS (2004): *Energy efficient commercial cooking.* http://www.aps.com/home

[10]Balogun (2004). Balogun S.A., Bodin J. B., Bikangi N., Rafiqul I., Jarlebring I.: *Cassava; The ultimate future crop*. http://www.nutrition.uu.se/Studentprojects /group97/cassava/cassava.htm#1.%20Introduction%20and

[11]Beeharry, Revin Panray (2000): *Strategies for augmenting sugarcane biomass availability for power production in Mauritius.* Biomass and Bioenergy, Volume 20 *(*2001) pp. 421–429.

[12]Bhattacharyya (2004). *The cogeneration potential of the sugar industry in Vietnam*. Subhes C Bhattacharyya and Dang Ngoc Quoc Thang. OPEC Review Volume 28, Issue 1, Page 63-80, Mar 2004

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