FARM WASTE UTILIZATION - NEW AVENUES FOR AGRI-BUSINESS

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INTRODUCTION

- Farm waste utilization is one of the areas that need consistent attention.
- Decreasing land holdings and stagnant crop productivity has made the agricultural activities non-remunerative
- A new dimension in the form of industry based on farm waste utilization as alternative fuel is the need of the hour

Table.1. Crop-wise Production (Million Tonnes) in India (2004- 2005 and 2005- 2006)

Crop	2004-05	2005-06
Rice	93.5	87.8
Wheat	79.5	75.5
Jowar	9.27	7.61
Bajra	7.22	8.55
Maize	15.1	15.4
Ragi	2.93	2.79
Barley	1.74	1.65
Small Millets	0.56	0.53
Pulses	15.3	-
Cotton	150	165
Jute	106	101
Mesta	12	11.6
Sugarcane (Cane)	270	238
TOTAL	**493.12**	**552.08**

- The straw to grain ratio varies from 1:1 to 1:5, taking the lower limit for estimation of minimum availability of residues, therefore about 552.08 million tonne of farm residues is available for use
- Mostly the agro residues are used as cattle feed, domestic fuel, thatching, manure, animal bed, fuel in brick kilns and for briquette manufacturing, and
- Rest is burnt or just left in the fields for decay

- Low bulk density makes it difficult to collect, transport and store the farm residues.
- Some suitable densification technology can make them suitable for transportation, storage and utilization as energy source at commercial level

- Various researchers have worked on gasification of farm waste as source of energy
- The work on briquetting as alternative fuel to coal was also taken up by various countries especially the developing ones
- India has 247 billon tonne of coal reserves out of which only 52.24 billion tones are extractable reserves

- During the 10th plan coal demand was of 332 million tonne while 301 million tonne was available and 31 million tonne was the shortage.
- This shortage is going to be 87 million tones during the 12th plan
- The coal should be substituted partially or fully, whatever option be feasible, with some kind of fuel based on farm waste

Table.2. Trend in production of primary commercial energy in India

Energy from	Unit	Production							
		1950-51	1960-61	1970-71	1980-81	1990-91	1996-97	2001-02	2006-07
Coal	MMT	33	55.67	72.95	114.01	211.73	288.05	325.65	405
Lignite	MMT	-	0.05	3.39	4.8	14.07	22.54	24.3	55.96
Crude Oil	MMT	0.26	0.45	6.82	10.51	33.02	33.87	32.03	33.97
Natural Gas	MCM	-	-	1.44	2.35	1.79	2.29	29.69	37.62
Hydro Power	BkWh	2.52	7.84	25.25	46.54	71.66	68.63	82.8	103.49
Nuclear Power	BkWh	-	-	2.42	3	6.14	9.01	16.92	19.3
Wind Power	BkWh	-	-	-	-	0.03	0.85	1.7	4

Table.3. Estimated medium-term potential of power generation from various renewable energy source in India

Resource	Estimated Potential (in MW)
Agro Residues & Plantations	61000
Wind Power	45000
Small Hydro Power (upto 25MW)	15000
Congeneration-Bagasse	5000
Waste to Energy	7000
Solar Power	50000
Total	**183000**

Fig.1. Share of Future Energy Supply

OBJECTIVES

- To explore the potential of utilization of farm waste as an alternative fuel
- To asses the potential of briquetting technology as an enterprise for rural youth to create employment
- To study the economics of a briquetting plant

POTENTIAL OF BRIQUETTING INDUSTRY

The potential of briquetting industry can be seen in two ways

- First is in terms of alternative fuel and
- Second is in terms of employment generation

ENERGY POTENTIAL

- Cooking : Hotels, Houses, Canteens, and Restaurants
- Steam generation : Boilers
- Melting metal : Forge and Foundries
- Space heating : Hotels, Houses
- Gasification : As a fuel for gasifiers
- Other applications : Brick Kilns, Tea curing etc.

- The present average energy short fall is of seven per cent and peak demand shortfall is of 12 per cent which is about 14.64GW
- The thermal potential of most of the biomass varies between 80 to 90 percent that of the coal
- If all the available farm waste is converted into fuel briquettes it can replace 184 million tonne of coal or energy wise it can produce about 9.2 GJ, which is about 62 per cent of the average energy shortfall of the country

Table.5. Biomass Briquettes Vs Coal

Fuel	Density (g/cm^3)	Calorific value (kCal/kg)	Ash content (%)
Coal	1.3	3800-5300	20-40
Biomass Briquettes from			
1. Saw Dust	1.10	4600	0.7
2. Groundnut Shell	1.05	4750	2.0
3. Rice husk	1.30	3700	18.0
4. Saw dust + cotton sticks	1.12	4300	8.0

EMPLOYMENT POTENTIAL

- The potential in terms of employment generation can be calculated by assessing the availability of biomass for briquettes
- Assuming the availability of farm waste for briquetting as 60 percent of the total farm residue produced. It implies that 331.2 million tonne of the farm residue can be briquetted

- Assuming that whole of the available farm residue has to be briquetted during the short span of its availability so that there should not be any need of transportation or storage of the residues, which otherwise will add to the handling cost
- For small scale industry at village level a capacity of 1 t/h implies that 41.4×10^6 days are required if the plant runs for 8 h in a day
- Assuming the availability of farm residue for 30 days, it will require about 1.38 million briquetting units in India

- One briquetting unit provides direct employment to four persons; therefore the briquetting industry can generate direct employment of about 5.52 million persons
- The potential of indirect employment can be imagined to the tune of 10 million persons; hence the briquetting industry can create job avenues for about 15.52 million people

ECONOMIC ANALYSIS

- To ascertain the feasibility of any equipment the calculations for its economics are essential
- The economics were calculated considering the briquetting plant as a farm level project
- The dimensions of the shed and storage space were considered as 15 m x 7.5 m
- The construction cost on the basis of current contract rates of Govt. of India (Rs 5445 per m^2) is about Rs 6,25,000

Table 6 Values of different heads for economic analysis

Sr No	Head (unit)	Value
1.	Initial cost of machine (Rs.)	12,00,000
2.	Life (yr)	10
3.	Annual use (h)	960
4.	Interest on cost (%)	15
5.	Depreciation (%)	10
6.	Junk value (%)	10
7.	Annual repair and maintenance	5 % of initial cost of the machine
8.	Labour required	4
9.	Labour rate (Rs/h)	15
10.	Average machine capacity (t/h)	1
11.	Fuel consumption (kWh)	9
12.	Fuel cost (Rs/kWh)	4.68 (commercial charges)
13.	Oil and lubrication charges	20 % of fuel cost
14.	Working capital (Rs/yr)	12,00,000

Fixed cost	= Rs. 4,29,000
Variable costs	= Rs. 12,98,035.2
TOTAL COST / YEAR	= Rs. 17,27,035.2

Revenue

1. Returns form 960 tonne briquettes @ Rs 3 per kg = Rs. 28,80,000
2. Assuming 5% losses during storage, Net Returns = Rs.27,36,000

3. Total revenue per year	= Rs. 27,36,000
4. Total costs incurred per year	= Rs. 17,27,035.2
5. Net profit per year (3-4)	= Rs. 10,08,657.5
6. Total initial cost	= Rs. 18,25,000
7. Payback period	= 6 months

SETTING UP OF BRIQUETTING PLANT

PURCHASE OF RAW MATERIALS

- **It is essential to collect the raw materials when they are dry and keep them dry**
- **When purchasing from others inspect the materials and pay lower amounts for dirty raw materials**

QUALITY OF RAW MATERIALS

- Selection of raw materials by inspection of all raw materials before the material enter the production line
- Constant adherence to cleanliness of raw material once the material enter into the production line
- Maintenance of cleanliness in plant at all time
- Maintenance of cleanliness of all components of the factory
- Maintenance of cleanliness of supplies to be used for manufacture and storage of the fuel briquettes
- Continual inspection of output products for cleanliness, freshness, color and quality
- Establish a program for listening to customer concerns and note problems they express about quality of products
- Establish a feedback program to correct any quality problems that occur immediately

ENERGY CONTENT OF BRIQUETTED FUEL

- Different waste materials have different energy contents. The customer may want to know the energy contents of the briquettes. For this purposes the briquettes should be got tested from some authorized laboratory

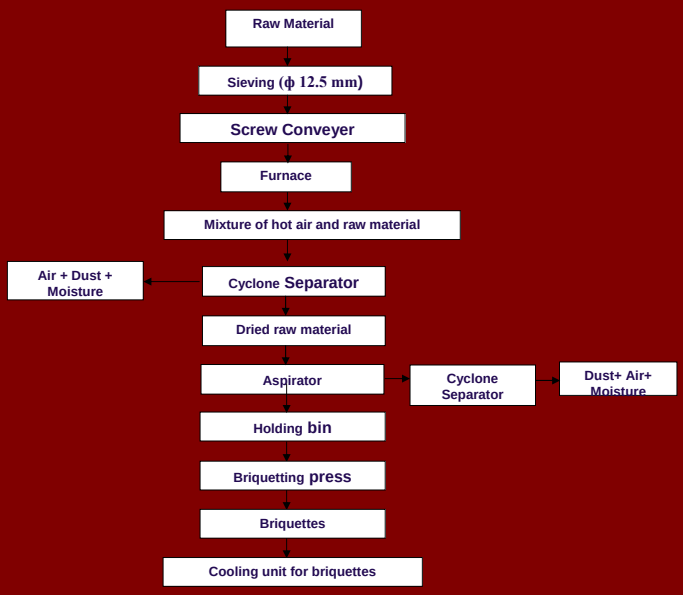

Fig. 2. Flow diagram for making briquettes from Agricultural waste

ADVANTAGES OF BIOMASS BRIQUETTES OVER CONVENTIONAL FUELS

Use of biomass briquette has been very successful in replacing fire wood in thermal application due to the following commercial considerations:

- Restricted availability of fire wood
- Higher flame temperature
- Its regular size allows firing the briquettes in small capacity boilers

- Use of loose biomass, industrial waste and the unscreened coal was responsible for high SPM level
- Briquettes due to low SPM generation during firing has replaced the conventional fuels in baby and mini oil extraction industry, small boiler in tyre retreading industry, and furnaces in chemical industry.

FUTURE NEEDS

- The engineering properties of various agricultural residues have to be determined
- To commercialize the briquetting technology some financial help should be extended to the industry
- Research and development activities should be taken by the institutes in collaboration with the industry

COCLUSIONS

- If all the available farm waste is converted into fuel briquettes it can replace 184 million tonne of coal or energy wise it can produce about 9.2 GJ, which is about 62 per cent of the average energy shortfall of the country
- The briquetting industry can create job avenues for about 15.52 million people
- The pay back period of the 1t/h capacity briquetting unit is 6 months

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